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Giants of Industry
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Los Angeles' Traffic Plan

Scientific Wonders of Chicago

Snow-Capped Equatorial Africa
By Carveth Wells

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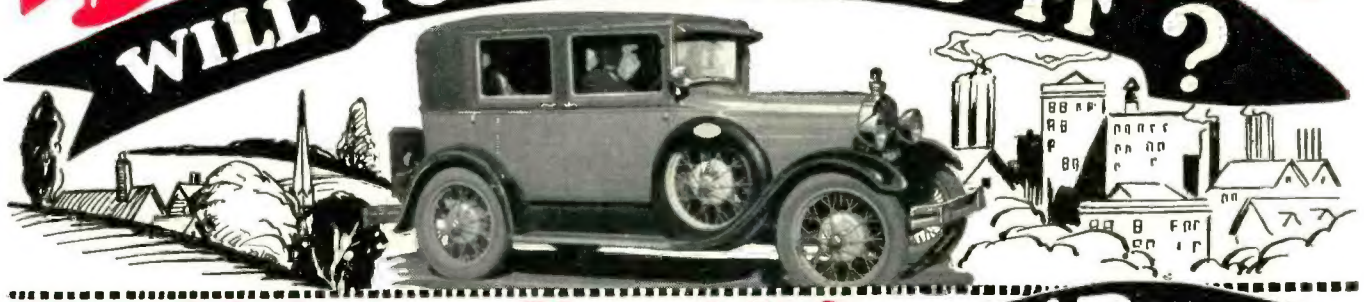

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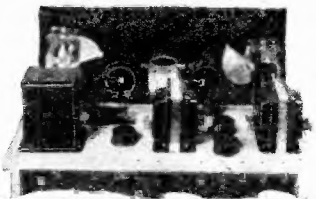

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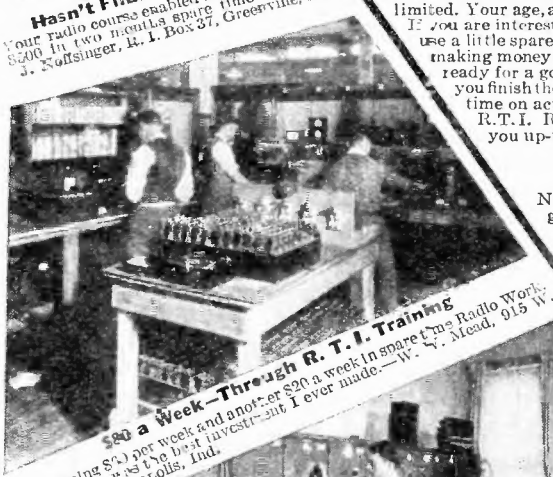

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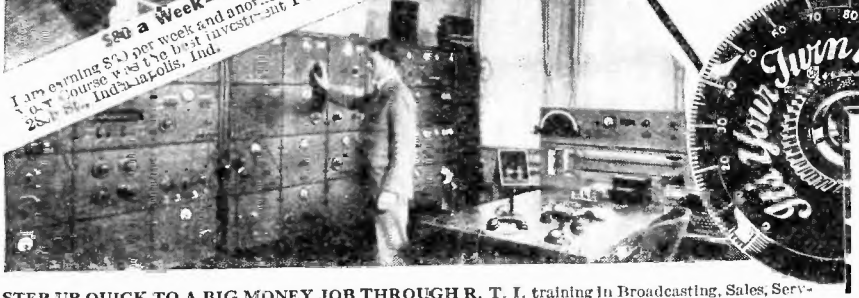

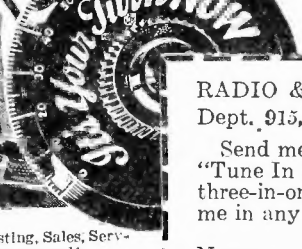

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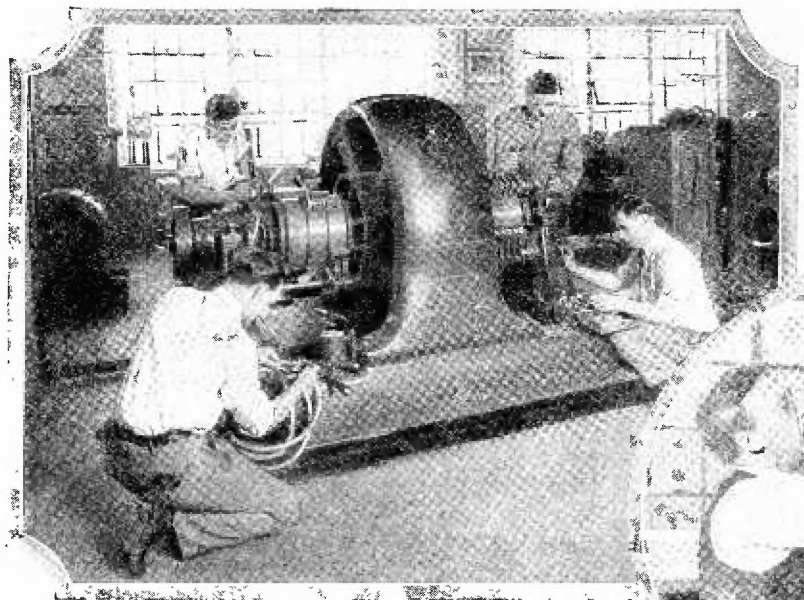
Sky-High Pioneers

Ewing Galloway

Silhouetted against the upper midtown district, these riggers are shown erecting scaffolding on the forty-fourth story of the Lincoln Building, New York, for the riveters and bricklayers who will follow. The Grand Central Building in the middle ground is actually three blocks distant from the camera.



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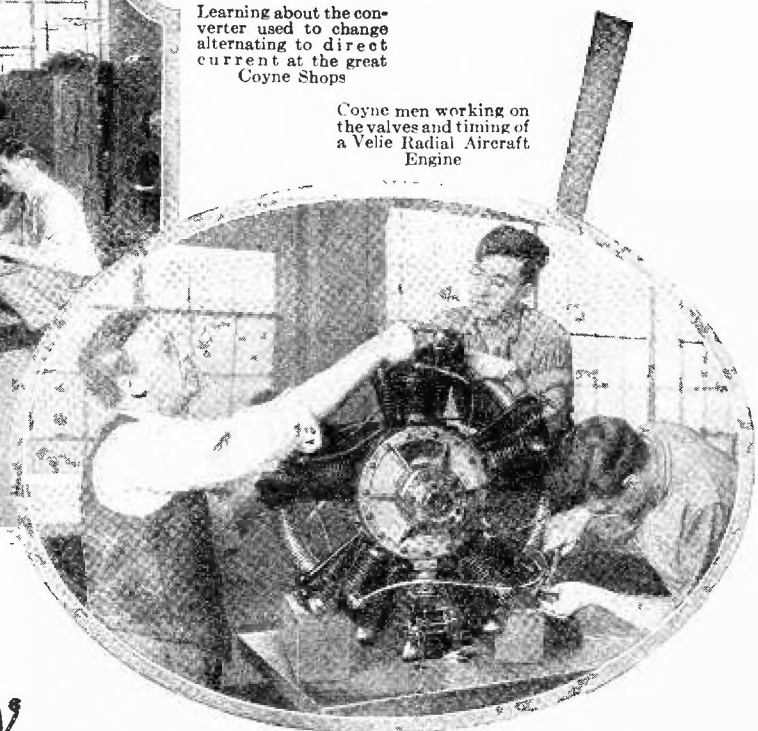

Coyne men working on the valves and timing of a Velie Radial Aircraft Engine

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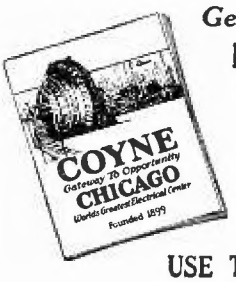

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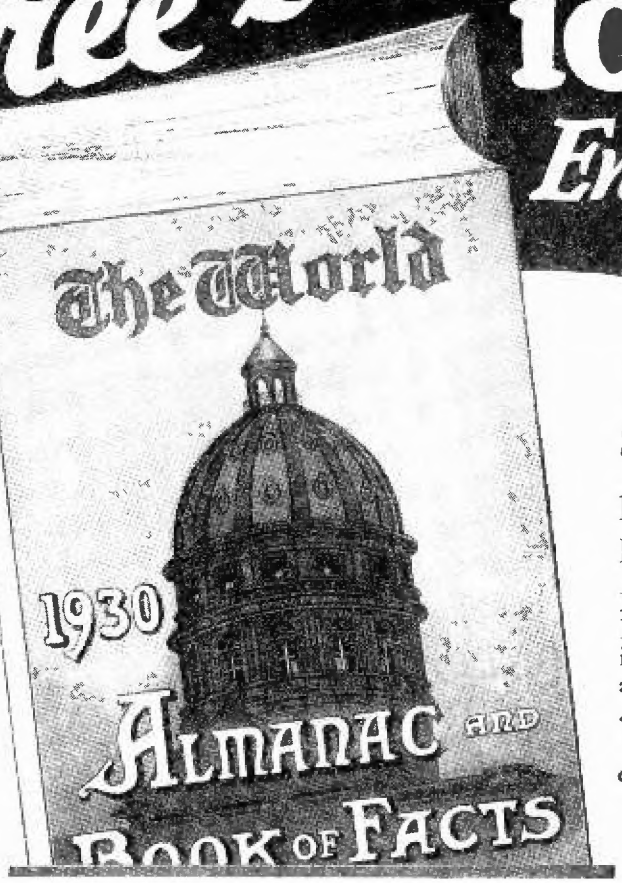

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If you were qualified for Radio Service Work today, we could place you. We can't begin to fill the requests that pour in from great Radio organizations and dealers. Members wanting full-time positions are being placed as soon as they qualify. 5,000 more men are needed *quick!* If you want to get into Radio, earn $3.00 an hour spare time or $40 to $100 a week full time, this R. T. A. training offers you the opportunity of a lifetime.

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Cash in on Radio's latest opportunity! Enroll in the Association. For a limited time we will give to the ambitious man a No-Cost Membership which need not . . . should not. . . cost you a cent. But you must act quickly. Filling out coupon can enable you to cash in on Radio within 30 days, lift you out of the small-pay, no-opportunity rut, into a field where phenomenal earnings await the ambitious. You owe it to yourself to investigate. Fill out coupon NOW for details of No-Cost Membership.

The Radio Training Association of America
4513 Ravenswood Ave. Dept. RN-5, Chicago, Ill.

THE RADIO TRAINING ASSOCIATION OF AMERICA
4513 Ravenswood Ave., Dept. RN-5, Chicago, Ill.

Gentlemen: Please send me details of your No-Cost training offer by which I can qualify for Radio Service Work within 30 days. This does not obligate me in any way.

Name .....

Address .....

City ..... *State* .....

MAY, 1930
NUMBER 1

Science and Invention

VOLUME XVIII
WHOLE NO. 205

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Editorial

Science In The Home

NO matter how great our interest is in any other subject, most of us derive a great deal of satisfaction from those little things which go to make our homes more livable. Whether we be men, women, boys or girls; whether we be interested in mechanics, electricity, economics, or any other subject, if we are normal humans we get a great deal of satisfaction out of improving and beautifying our dwelling places. Attractive surroundings assist us materially in enjoying our particular hobbies.

It is surprising to find the difference we can bring about in the bathroom, for instance, by the application of the contents of a ten-cent can of white paint. Similarly, a few cents worth of curtain material in the hands of a capable woman can transform the appearance of a bedroom or kitchen in an astonishingly short time. Old, dilapidated, and discarded furniture can be given a new lease on life by the intelligent application of a little paint, lacquer or varnish.

The more ambitious among us find it desirable, as well as handy, to accept the offers of some of the wood manufacturing companies which provide us with such useful items as kitchen cabinets, bookcases, tables of one sort or another, or even complete breakfast nooks, furnished in knock-down form and sent us through the mail. Cost of furniture of this kind is quite low. It is very simple to assemble and with the artistic application of just a little paint it can be used to add to the effectiveness of almost any home.

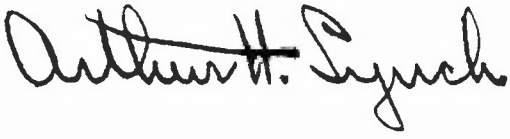
More and more we are coming to realize the real saving that can be effected in our coal bills as a result of properly installed insulating material which may be applied with almost equal ease to existing homes or those under construction. Figures covering this situation, prepared by the Bureau of Standards of the Department of Commerce, indicate very definitely that the saving in fuel effected by properly installed insulating material pays for the latter within a period of two or three years, to say nothing about the more comfortable living conditions for winter and summer which the installation of this material brings about.

Just a little plaster of paris, whitewash, or cement can result in effecting savings in our garrets, cellars and garages which amply warrant the few minutes necessary for their application.

Quite contrary to the general belief, the carrying out of simple schemes for improving the appearance of our abodes do not require a very expert knowledge, or a very practiced familiarity with tools. Some of the most effective small repairs, or small additions, may be made without any previous knowledge of tools whatever.

We feel that there is plenty of opportunity for the practical application of science in our homes and that a great majority of our readers will derive much satisfaction from the application of inventive ideas.

Articles of this nature appear continuously in SCIENCE AND INVENTION and it is our purpose in the future to increase their number. We are making a serious effort to make articles of this character as completely worth while as possible and shall greatly appreciate any coöperation which any of our readers feel they can give us in this connection.



"Those Who Refuse to Go Beyond Fact Rarely Get as Far as Fact" - - - - - HUXLEY

"Select the car you like . . . *then try it out for 5 days!*"

"That should give me time enough to make sure I like the car."

"Yes sir. And every *used car backed by the famous Studebaker Pledge carries the same privilege—five days' driving trial!"*

The privilege of trial by the jury of your family—and *five days* to reach a verdict! That's what the famous Studebaker Pledge permits when you choose a used car under its protection!

You drive it—your wife can drive it—you can test it in any reasonable manner for five days. Then, if you're not satisfied, you may return it and apply your payment on *any* car in your Studebaker dealer's stock—*new or used!*

The Studebaker Pledge also provides a 30-day guarantee on all Certified cars, as well as the assured protection of plainly marked prices—one price for every buyer!

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1 Every used car is conspicuously marked with its lowest price in plain figures, and that price, just as the price of our new cars, is rigidly maintained.

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3 Every purchaser of a used car may drive it for five days, and then, if not satisfied for any reason, turn it back and apply the money paid as a credit on the purchase of any other car in stock—new or used. (It is assumed that the car has not been damaged in the meantime.)

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Please send me copy of "How to Judge a Used Car."

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STUDEBAKER

Builder of Champions

The *proof* that Ethyl develops more power

Right: This is the instrument board of a "knock" demonstration machine. The wattmeter (at the left) registers power. The tachometer (at the right) records engine revolutions per minute. When this picture was made, the engine was running on ordinary fuel.

Below: When the lower picture was taken, Ethyl had been fed into the carbureter. The wattmeter shows that the power has risen to the maximum; the tachometer shows a corresponding increase in revolutions per minute.

Knocks out that "knock"

ETHYL GASOLINE

"SEEING is believing." These pictures of a "knock" demonstration machine let you *see* how Ethyl Gasoline will increase the speed and power of your motor.

A simple valve switches the fuel from ordinary gasoline to Ethyl and back again. When Ethyl goes in, "knock" goes out, R.P.M.'s (engine revolutions per minute) increase, power goes up. That is how Ethyl improves motor car performance.

It is the Ethyl anti-knock compound in Ethyl Gasoline that makes the difference. This remarkable fluid was developed by General Motors Research Laboratories after years of experiment to find an ingredient which would make gasoline a better fuel. Make this convincing experiment in your own car. Use up the ordinary gasoline in the tank; then fill up with Ethyl. You'll see and feel the difference.

* * * *

Wherever you drive—whatever the oil company's name or the brand associated with it—*any* pump bearing the Ethyl emblem represents quality gasoline of anti-knock rating sufficiently high to "knock out that 'knock'" in cars of average compression and bring out the additional power of the new high-compression cars. Ethyl Gasoline Corporation, New York City.

©E. G. C 1930

The active ingredient now used in Ethyl fluid is tetraethyl lead.

SCIENCE *and* INVENTION

Volume XVIII. Number 1

MAY 1930

Speeding *the* World's Words

An Interview with Herbert W. Drake of Western Union on the Marvels of Modern Telegraphy

By Mary Jacobs

"THE day of the lone inventor has passed. No longer does a solitary individual tear his hair, lock himself in his workshop or attic, and burst forth a few months later, shouting 'Eureka, I've found it!'" says Herbert W. Drake, Apparatus Engineer of the Western Union Telegraph Company. "Today a group of scientists, each a specialist in his field, comes together and talks matters over. Each considers the problem from his individual angle—and in time the invention emerges—the joint work of many."

It is for this reason that Mr. Drake, who has been working for his company nearly forty years, considers himself only partially the inventor of various telegraph systems, and of the 100-wire concentration unit recently developed to expedite the handling of telegrams. This latest mechanism enables a single operator, without changing her position, to send or receive messages on any of 100 lines; enables her to tell at a glance which lines are busy, which ones require attention. How was this achieved? That is the story, and one must begin at the beginning.

"Telegraphy," says Mr. Drake, "has been changing rapidly in the last decade from the older manual systems to those where automatic printing machinery is used. The Morse dot-and-dash method circuits have been replaced by those with super-typewriters at both receiving and sending ends, until now more than eighty percent of the telegraph business is handled automatically. Of course, many more messages may be transmitted now in less time. Under present conditions, trunk lines connecting big cities can carry as many as eight messages, simultaneously, over the same wire, each at a rate of 50 to 60 words a minute. Their speed is limited to a great extent by the desire for absolute accuracy. It's quite conceivable that one or even two thousand words per minute might be handled on a circuit—but, if we did so, the proportion of errors might be increased.

"Using the old Morse system, an operator who could master the code of dots and dashes and receive them at the rate of thirty or forty words per minute was 'good.' In printing telegraphs we use the five-unit code devised by Baudot late in the nineteenth century. In this code each character is represented by five electrical impulses and therefore occupies the same time in transmission as any other character. A great saving in time and ease of operation results—for example, to transmit the letters E and J equal fractions of a second are required now. But under the Morse code system, E would occupy four time units and J would occupy fourteen, and thus it would take three and a half times as long to telegraph a J as an E." For operation of both Multiplex and Simplex printers, this five-unit code is essential.

Herbert W. Drake, Apparatus Engineer, who sees telegraphic advance as the result of joint intelligent effort.

"About twenty years ago, the Multiplex machine was developed to speed messages between large city terminals. It provided duplex communication channels which work simultaneously in both directions. . . . Four messages may be sent each way at a rate of about a word a second per channel, or 480 words per minute over one trunk line! The machines are constantly in operation at both ends—no starting or stopping impulses are required—these are supplied automatically by synchronous machinery.

"The Multiplex took care of our large city-to-city telegraph business, but what about the feeder circuits, those short circuits that bring messages to the large city terminals for transmission? We had to devise apparatus to make these feeders keep pace with the main transmission service. So we experimented, and finally adopted the Simplex printer, a long distance typewriting machine. As the letter of the typewriter keyboard is depressed, electrical impulses go directly to the telegraph line, and instantaneously the corresponding type bar registers at the receiving end. Letters are hurled from one point to another with a speed approaching that of light."

Installation of these machines in customers' offices connected with local Western Union headquarters made it necessary to develop a method for handling the business at the wire headquarters with the greatest possible efficiency. The answer to this problem was the invention of the 100-wire concentration unit, which presents the spectacle of a complicated system operating with what would impress the average person as almost human intelligence.

When a patron wants to send a telegram in, the light corresponding to his wire flashes. The operator plugs in, and her machine automatically records the message. As she takes the call, a *(Continued on page 62)*

Arctic Fever

By Carveth Wells

Fellow of the Royal Geographical Society and the American Geographical Society

CARVETH WELLS was born in 1887. Before he was six he could sew, knit, crochet and make baskets, while his hobby was the breeding of silkworms and white mice.

At seven he won prizes for swimming and Latin, and his school report for his seventh year states: "He is making good progress, but is inclined to be talkative!" He is now one of the most famous lecturers in America, and is internationally known.

After receiving a classical education at St. Paul's School, he graduated from London University as a Civil Engineer and practised his profession for a time.

He is now a professional explorer, has led expeditions to the Arctic, Desert and Jungle, and has demonstrated the fact that it is far more profitable to talk about engineering than to practice it.

The Elena is one of several great glaciers found in Central Africa at an elevation of 15,000 feet.

THESE are the days of Ripley, Lowell, Horn and Halliburton—but believe it or not, no one has ever yet found me guilty of making a single misstatement of fact.

President Thwing of Western Reserve University says that I have an uncanny knack of making the truth sound like a lie, but this is not purposely done—it is natural.

As far back as 1918 I brought to America, from the Malay jungle, amazing stories of fish that climbed trees, singing earth-worms and bouncing fish balls. For six years I had lived in Topsy Turvy Land where monkeys wash their teeth, birds sleep upside down, animals fly, crabs eat cocoanuts, fish eat coral, rats live on the tops of tall trees, and people dress and undress without undressing!

Porters walking through snow on the equator insisted on carrying their boots around their necks as ornaments.

At an altitude of 12,000 feet lobelias grow ten feet high and the ground is covered with everlasting flowers.

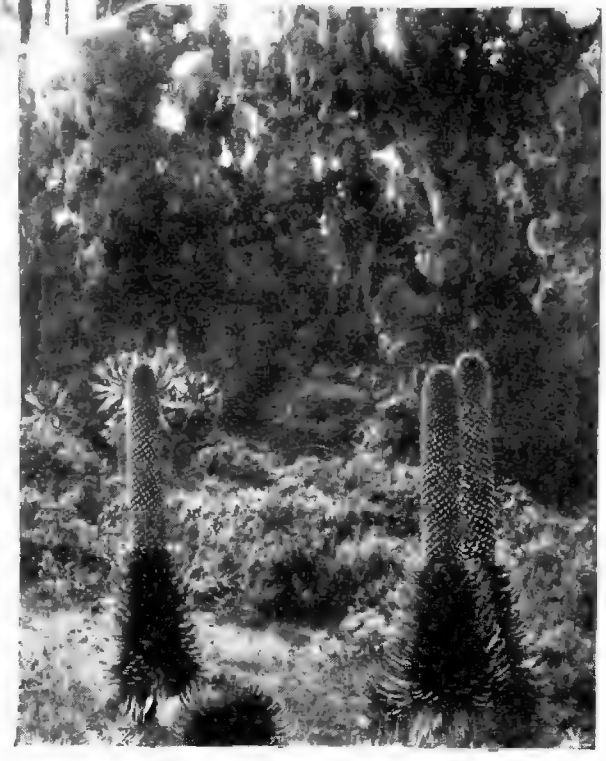
I soon discovered that the world was full of people who knew everything and became rather annoyed when they heard of something they never knew before.

It is a strange fact that most people have very fixed ideas concerning the rest of the world which they have only read about. To them, the Arctic is freezing cold, and swarms with Eskimos, seals and polar bears chasing one another about enormous icebergs.

Deserts are sandy places as hot as Hades, full of romantic sheiks.

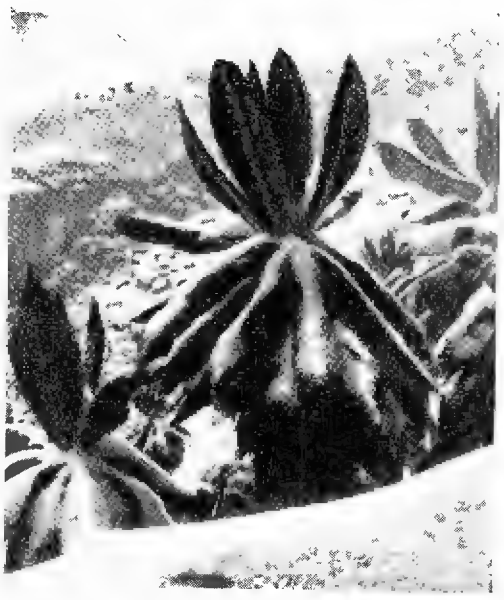
Central Africa is a steaming jungle full of lions and swarming with snakes, where one takes one's life in one's hands, and where brave men take movies of wild animals, risking all for the sake of science and in order to provide Broadway with a few real thrills.

Tell these people the truth, and they become annoyed. Show them pictures of Arctic Lapland sweltering in the summer sun, inhabited by people who have never even heard of an eskimo or a polar bear, and they shake their heads and say "I don't think." Gently whisper that hippopotami do not rush through flaming forests and leap recklessly over precipices into a river hundreds of feet below; that lions are harmless and do not hunt Boy,



and Tropic Frostbite!

Lightning Flashed, Thunder Crashed, While the Wells Expedition Struggled on in a Blinding Equatorial Snowstorm . . . and Reached the Enchanted Forest Where Heather Grows Fifty Feet High . . . That Is Africa, as Carveth Wells Found It on His Trip to the Mountains of the Moon



Central Africa is not at all an impossible place for skating and tobogganing the year round. Here the party was delayed two days by a snow storm. The temperature was 22 degrees.

Scouts; that headhunters do not capture inoffending travelers; that the so-called "Jungle of Africa" looks like Central Park and is just as dangerous, and they will say, "I don't believe you. I've actually seen it in the Movies!"

Finally inform them that Central Equatorial Africa is as truly arctic as the North Pole, and that the great danger is *not* from wild animals, but from *freezing to death*, and they say "Liar!"

Nevertheless, such is the fact. I have suffered intensely from Arctic heat and Tropic cold. I have seen fish living in water that was hot enough to cook them if they had been dead, and I know of live fish being shot from active volcanoes and from artesian wells in the middle of the Sahara, but it takes a Ripley to make the man in the street believe it. I certainly hand it to Ripley; he is one of the world's most useful educators.

A forest of gigantic birdseed in the Butago Valley, at an elevation of 14,000 feet, in the Mountains of the Moon.

At the left is a piece of parsley nine feet high and the explorer is standing alongside a piece of groundsel in blossom. Groundsel normally grows to a height of four inches. This plant is 25 feet high.

It was with the definite object of proving that Central Equatorial Africa was not at all an impossible place for winter sports, that I recently led an expedition to the Mountains of the Moon, for the Geographic Society of Chicago and the Milwaukee Public Museum.

Before I had been a week in Africa I found that the word "jungle" was never used, but in its place the word "blue," because the country was so open that the horizon in any direction fades away into a haze of blue.

On the way to the mountains I saw Boy Scouts chasing lions with bows and arrows, the only danger being from jiggers—and even *they* had been imported by some thoughtless person from South America (the jiggers, not the scouts!)

I actually went fishing for lions, using for bait a dead zebra which was used as a spinner, and trailed behind a seven-passenger Buick! I saw positively and photographed millions of *fly swatters* attached to the tails of gnus. I timed the animals sprinting about in the "jungle" at forty miles an hour—but that is all the gnus that's fit to print.

As I made my way across Kenya Colony, I disturbed a colony of thirty million flamingoes, those bright pink birds whose method of feeding has earned for them the popular name of "Vacuum Cleaner birds."

For hundreds of miles I motored along the equator, huddled up in my winter overcoat, shivering with (*Continued on page* 59)

Captain Frank Hawks pioneered airplane-towed glider flight in the United States, when he hitched on behind a powered ship for a ride between Orion, Mich., and Cleveland

Wings for Us All!

The Task of Making a Nation of Flyers Is Off to a Gliding Start

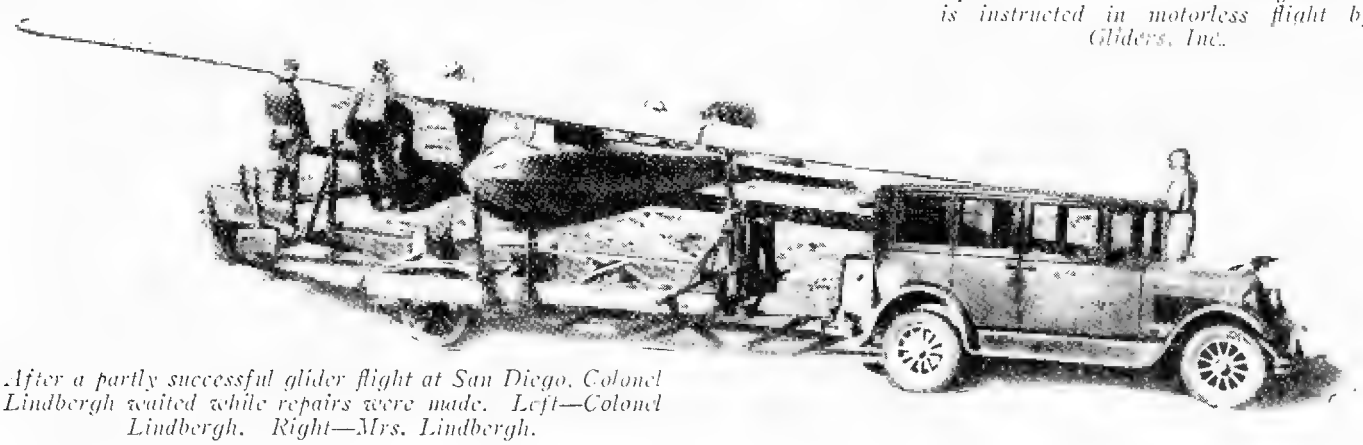
By Karl S. Betts, N.G.A

RECOGNIZING that 1930 is the first great American gliding year, Augustus Post, Aviation Editor of SCIENCE AND INVENTION, and gliding pioneer, has pulled the shock cord on a campaign for *municipally owned gliding fields* throughout the country. . . . The Exchange Club is co-operating with Mr. Post in his project for making the next generation a flying generation, to the last boy—and girl—in the land.

GLIDER activities throughout the United States will reach their peak in September of this year with the staging of the first National Gliding and Soaring Contest somewhere in the vicinity of New York City, according to officials of the National Glider Association in Detroit. Aircraft makers and civic organizations have joined in a nationwide effort to interest thousands of persons in aviation through the new sport of motorless flying. William B. Mayo, Chief Engineer of the Ford Motor Company, and President of the National Glider Association, estimates that there will be one million glider pilots in America by 1935. Charles L. Lawrence, William B. Robertson, Admiral William A. Moffett, Amelia Earhart, and other aviation leaders concur with this view and are lending their efforts to carry through an ambitious expansion program.

By March of this year, thirty-five glider clubs had been organized and had affiliated with the national association, and approximately fifty more were in process of organization. Many of these clubs have been sponsored by Boards of Commerce, Exchange Clubs and other organizations, and have purchased gliders for training. Girls' glider clubs have been formed in Buffalo, New York and Cincinnati, and the Universities of Utah, Detroit and Michigan are actively engaged in teaching students to fly. The Bowlus Glider Club (*Continued on page* 61)

Up at Orion, Mich., the budding aviator is instructed in motorless flight by Gliders, Inc.

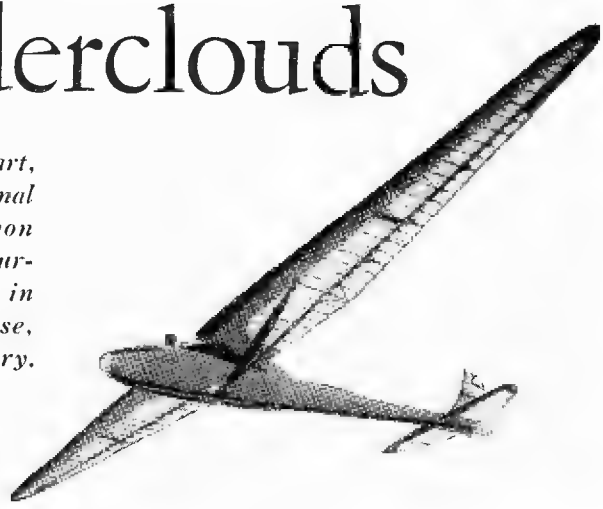


After a partly successful glider flight at San Diego, Colonel Lindbergh waited while repairs were made. Left—Colonel Lindbergh. Right—Mrs. Lindbergh.

Riding *the* Thunderclouds

Martin H. Schempp is a graduate of the University of Stuttgart, where he also studied gliding under the pioneer international gliding champion, Wolf Hirth. Continuing in aviation, he won his international sport pilot's license, and gained a manufacturing knowledge of both gliders and power planes. He landed in New York last year, and became instructor of the Syracuse, N. Y., Glider Club, one of the most active in the country.

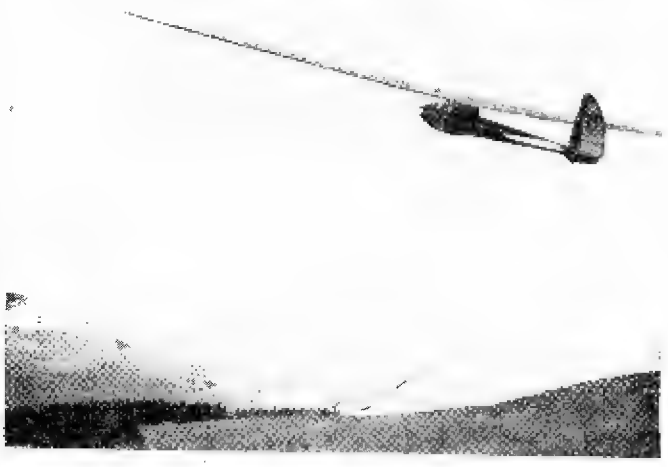
By Martin H. Schempp
Pilot and Instructor



Robert Kronefeld soared to altitude and distance records on the wings of a thunderstorm.

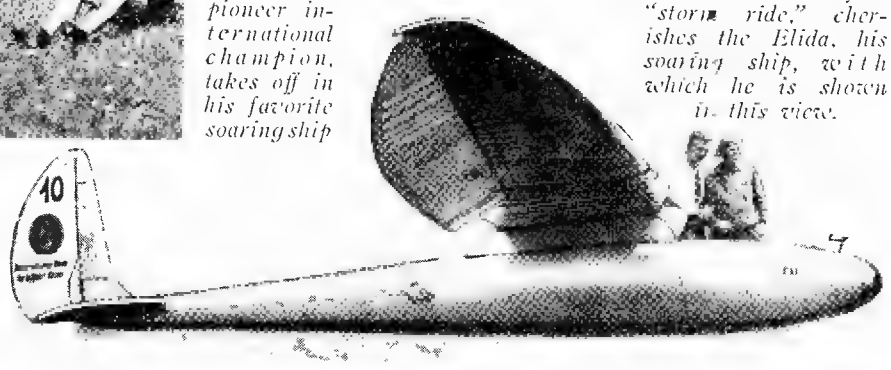
ALTHOUGH successful gliders are being built and flown in the United States, soaring gliders and soaring flight are still rare. Germany, with ten years of experience in motorless aviation, still leads the world in the advanced phases of this form of flight.

I know that the enthusiasm of this country for gliding will overcome the Germany advantage within a short time, and that the art of soaring flight will reach a high development on this side of the Atlantic. Meantime, as an intimate associate of Germany's soaring aces, and as a holder of a German soaring license, I should like to tell you something of the methods by which motorless flights to altitudes up to 6000 feet, for distances of 100 miles, and of 15 hours' duration, have been achieved in my native land.



The shock cord is pulled, and a soaring plane starts from the "Wasser Kuppe," highest peak in the Rhoen district.

Wolf Hirth, pioneer international champion, takes off in his favorite soaring ship



Max Kegel, the German veteran who took the first "storm ride," cherishes the Elida, his soaring ship, with which he is shown in this view.

Until 1926, German glider pilots depended on hill upwinds for successful soaring flights. Nevertheless, flights lasting several hours had been made by pilots who cruised to and fro in these ascending currents caused simply by the physical characteristics of the earth itself.

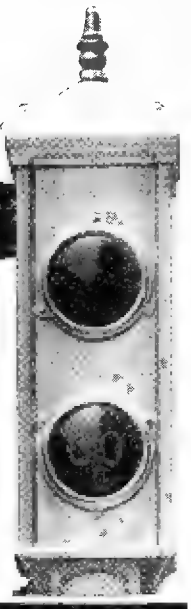
During the glider meet of July, 1926, however, in the Rhoen Mountains, there took place an event which produced a vital change in the technique of soaring flight. The veteran pilot, Max Kegel, was making a flight in the ordinary way when he was caught in a suddenly rising thunderstorm. Threatening clouds came rolling upward toward the mountain tops, and Kegel drove directly into the blow. Traveling at a terrific rate, he disappeared from the view of the amazed spectators. Later it developed that the upwash carried him to an altitude of 4000 feet, over a distance of 40 miles. The flight lasted three-quarters of an hour.

Kegel told afterward of his thrilling ride on the wings of that mountain storm. Caught in an aerial whirlpool, he was pitched about by violent crosscurrents, while visibility went to zero in a dense mass of turbulent foam.

Perhaps something of the ancient seafaring adventurers of the Baltic survives in our German glider pilots. At any rate, no sooner had the news of "Max's stormflight"—it became known at once by that name—reached them than they began an intense study of cloud formations. No other thought seemed to occur to them than that here was a source of power which they could utilize for flights to altitudes never previously reached. Out of hand, they determined to make a steed of Thor!

You have noted those characteristic woolpack clouds, with a dome-shaped upper surface (*Continued on page 66*)

Los Angeles says: STOP to Traffic Congestion and Accidents



A continuous poster campaign is a feature of the safety activity in the schools.

Los Angeles has built forty pedestrian tunnels like the one above at a cost of $10,000 *each.*

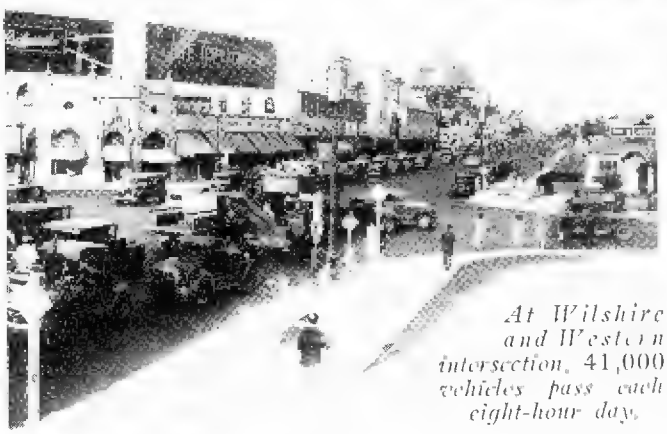
By Arthur G. Arnoll

General Manager, Los Angeles Chamber of Commerce.

FACED with an adverse total of about 400 traffic fatalities yearly, and with a traffic frequency at certain intersections of 41,000 vehicles per eight-hour day, Los Angeles is exerting itself vigorously to solve the twin problems of congestion and accidents.

A notable feature of Los Angeles' persistent campaign for safety and freedom from congestion is the emphasis placed on the drivers of tomorrow — the children in the city's schools.

Advanced physical and mechanical safety and traffic aids are being installed. And at the same time, a continual campaign is kept up for the education of the individual from both the driver and pedestrian point of view.



At Wilshire and Western intersection, 41,000 vehicles pass each eight-hour day.

Auto Club, So. Calif.

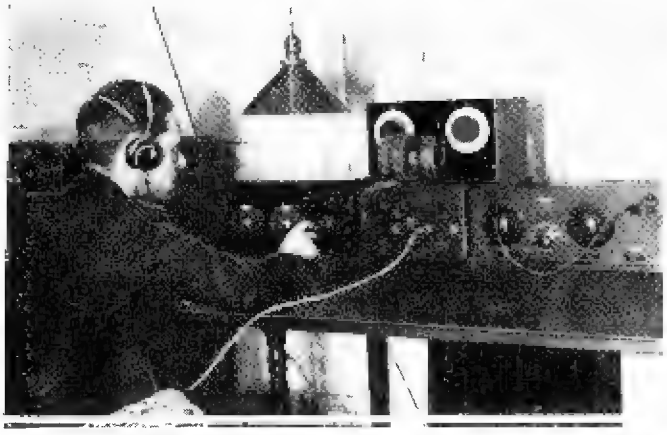
Los Angeles has carried out the use of one modern safeguard to an extent observable in few cities of its size. In all there have been forty underground passageways, costing an average of $10,000 each, constructed beneath dangerous street crossings. Crossings thus guarded of course afford absolute protection for the school child while permitting the free flow of traffic as well. Where streets must be crossed at grade, police officers are detailed to protect the children. An interesting experiment is being tried with the "cafeteria" type of stop signal, which is operated by the child himself, but results with these devices are not yet regarded as either conclusively satisfactory or the opposite.

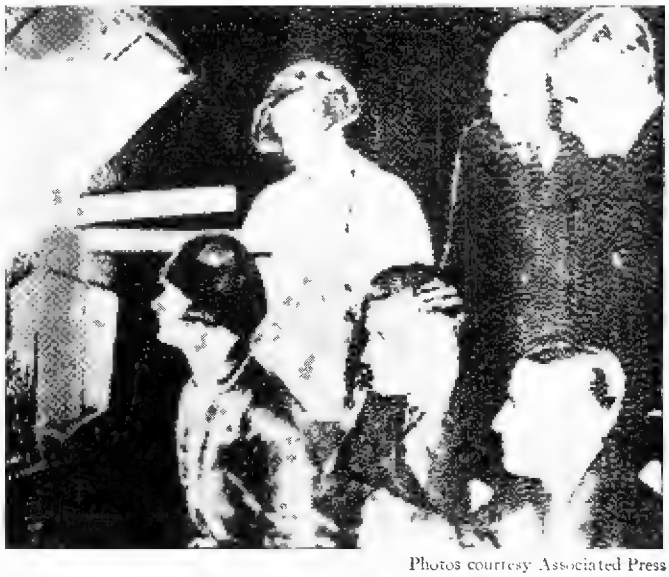
The importance of pedestrian protection and education is apparent in the accident statistics for the city, which show that 50 per cent of all fatalities occur to persons on foot.

Automatic signals are employed at 491 intersections. In addition to bells and lights, these signals are equipped with semaphore arms carrying "stop" and "go" signs, which raise and lower in synchrony with the corresponding colored lights. Metal markers and painted lanes help the motorist at busy intersections. Los Angeles uses the four-button marking system instead of the single-button method employed in many cities. Only 30 percent of the total accidents occur at intersections thus equipped.

The educational campaign among school children includes talks by teachers and traffic experts, the organization of school safety committees, and the award of badges, buttons, and citations for meritorious effort. Posters pointing out traffic perils (*Continued on page* 62)

Drive-in markets offer shopping facilities that keep the streets clear of parked cars.





With this set contact was kept with the London transmitting station during the first attempt at trans-oceanic television. The radio photograph at the right shows Mrs. Mia Howe sitting before the London transmitter; it was "received" in the United States on the day of the event.

Photos courtesy Associated Press

Eyes Across *the* Sea

By William Watts Chaplin

William Watts Chaplin returned from service with the Yankee Division to a career of freelance writing and reporting. For seven years he worked on the staff of the Associated Press, specializing in reporting events of vital significance in television, air transport, naval aeronautics, and other scientific fields. Time after time he saw at close range a great experiment in its initial instant of success. Thus he is particularly equipped to write for us this dramatic close-up of trans-oceanic television.

SUDDENLY in the dark cellar, as three men knelt on the dusty floor and held their breath, a woman's face appeared in shifting light to grin distortedly, grimace and smirk and nod, fading then back to oblivion.

It was the face of a woman who was not actually present, was not for the matter of that even in America, and yet this was no spiritualistic seance. What the three men in that cellar had just seen was the first demonstration of transatlantic television.

In ten years of reporting this was one of the biggest thrills I ever encountered, and now looking back over the reportorial experiences of that decade I am surprised to realize that with few exceptions it was the assignments with at least some scientific flavor that held the biggest emotional moments, the truest romance, the most exciting "kick."

I had seen something of television before that trans-oceanic experiment. But by a wide margin the most dramatic was that far from perfect test between London and New York in the Winter of 1928.

Captain O. W. Hutchinson, a promoter for the English Baird interests, had come over here to stage the demonstration largely for publicity purposes—to dramatize television for the public just as aviation was dramatized by the first Atlantic flights; and I arranged with him to be the only reporter present. Several papers and news services had got wind of the fact that something of the sort was in the making, and keeping the story "under the hat" during the month of preparation was a difficult task.

Capt. Hutchinson was preceded to this country by a month by Edward Clapp, a radio mechanic who conducted the preparatory work with Robert M. Hart of Hartsdale, N. Y., a radio amateur who had offered his short wave set for the experiments. At last everything was in apparent readiness and I went to the Hart home on a blustery cold night to find the house imbued with an air of nervous expectancy, Hutchinson and Clapp down in the cellar where the portable televisor was set up on a kitchen chair and Hart on the second floor at his radio.

But all the worry went for naught. Atmospheric conditions were unfavorable and the result of repeated trials was only disappointment. Twice more I went to the Hart home to no avail, but then came the big night and the thrill of a lifetime.

When I went down to the cellar Capt. Hutchinson was talking on a house telephone with Hart upstairs and raised a hand in greeting under a red light.

"Hart's talking to London now," he said, hanging up the receiver. "It looks pretty good. Baird is just going to try sending the image of Mrs. James Howe." Jim Howe was an A. P. man in London and the only reporter present at that end.

Hutchinson slipped a pair of earphones on my head and I heard a rhythmic hum like the lazy song of a honey-laden bumble bee—the carrier wave. And then came a different sound, high, squeaky, constantly changing in tone—the image.

The red light was extinguished. The mechanic moved levers. Flickering radiance appeared in the televisor's opening, much the sort of opening into which you press your face in one of those machines in a penny arcade. There was a feeling of tension, expectancy. The mechanic kicked away his stool and we knelt beside him.

The lights whirled and danced, clotted and disintegrated, formed in strange patterns and burst like a shower of sparks. And then suddenly they arranged themselves in orderly fashion and before our eyes there grew into being the illuminated face of a woman. She smiled with a grotesque widening of the mouth, moved her head from side to side, nodded. It could hardly have been more startling if she had suddenly called us by name.

Capt. Hutchinson, the typically well-groomed and suave-mannered Englishman, scrambled to his feet and slapped me on the back. We all laughed and exclaimed and the little mechanic groped about to shake our hands in the darkness relieved only by that face of light.

"I must tell Hart," the Captain said excitedly and rang the buzzer on the house phone. "Hart," he yelled, "Clip down here jolly quick, will you? It's a blinking success."

We heard Hart's feet pounding the carpeted stairs to the ground floor and then the (*Continued on page* 63)

Behind *the* Human Front

By
Edward J. Beck

We're All Psychologists. Each of Us Has His Own Way of Detecting What Goes on in the Minds of Others. This Article Recounts Acute Psychological Observations by Ordinary Folks

A HUSBAND and wife were pouring out their grief over the counter of the taxidermist's shop. It seems that King Tut had died. There had never been a dog like him and would never be another. The woman was audibly sobbing and the man stopped short in the midst of his canine eulogy to wipe some tears from his cheek.

Would my friend, the taxidermist, send a man out at once to pick up the remains and stuff them? It would be such a comfort to have even the *image* of the dog around the house, now that his friendly soul had passed on.

The taxidermist listened with sincere sympathy. He loved dogs himself and understood. However, on work like that, he stipulated, full payment in advance was required. No, a deposit would not do. The customer was finally pinned down to writing out a check and after some parting instructions—"You won't forget this, will you? Or neglect that?"—the tearful couple left the shop.

"Why were you so insistent about cash in advance? That fellow is good for the money," the taxidermist was informed. "That's old man Smith's son, of the Smith paint and varnish plant. He's in line to inherit a million dollar business."

"I know that," was the reply. "I was just trying to save myself some grief."

"What do you mean?"

"Just this. There are secrets in every trade and I got wise to one that applies to my line years ago. Whenever a customer comes in to have a pet dog, cat, parrot or what not mounted and he weeps when he tells you about it, be sure and get your money in advance. Otherwise you'll never get it. Even the rich boys will try to welch on you.

"You can take a chance on the fellow who gives you an order in a matter-of-fact way. He, too, mourns his pet—otherwise he wouldn't want to have him mounted. But he knows his own mind. He'll call for the finished job when it's done and pay you. The weepy ones won't."

"How do you make that out?"

"Well, I figure that anybody that will weep before strangers about a dog or cat has his feelings on the surface. He's excitable. Today he feels one way and the next time you see him he'll be just the opposite. His mood is easy come, easy go. You can't afford to stake any cash on his intentions. He forgets them. The dry-eyed customer is more apt to run on an even keel. I can't do like a laundry man—sell the shirts that aren't called for. Nobody will take somebody else's mounted dog for a gift. So I've got to protect myself against the crying kind. It cost me a thousand dollars to learn that."

It is really too bad that there isn't a learned journal to which the butcher, the baker and the malt extract maker could contribute their discoveries about human nature as the professors do. Because they do make such discoveries. The taxidermist had probably heard of William James or Sigmund Freud, and if you sounded him out on the "emotional instability" that the psychologists talk about, he'd give you a stare as glassy as the eyes he installs in elk-heads. Just like the Frenchman who had talked prose all his life without knowing it, this craftsman who understood how to turn fish and antlers into interior decorations had the real low-down on some of this psychological stuff with the big names. But he lacked the highbrow shipping tag that would get his observations to the reviews. And he didn't realize that he was using psychology as well as papier-mâché and plaster of Paris in his business.

People collect almost everything else today—street car transfers, photographs of misspelled signs, coal oil lamps, pictures of Robinson Crusoe—so why would it not be a superior hobby for any person with a background of psychological theory to collect bits of insight into human nature from grocers, bell hops and merry-go-round ticket-takers?

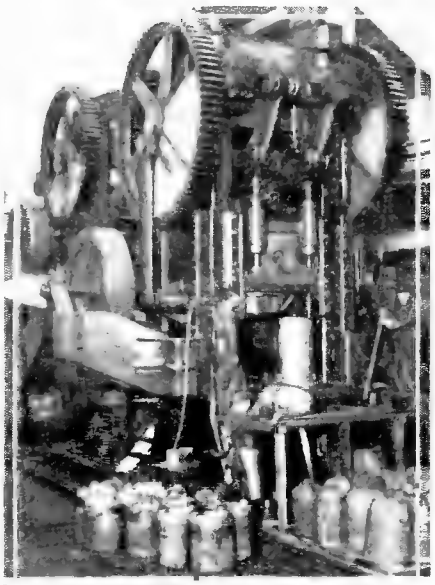
Of course, you must not expect the grocer to "know his groceries" about anything but his groceries. He qualifies as an expert only in that little sphere where human nature and groceries meet. But every one of us watches the game of life through a vocational knot-hole and we get to know about some fine points of the game in the part of the back-field near our knot-hole that are completely overlooked by the experts in the press box.

A hotel clerk, for example, was complaining that guests swiped all sorts of things out of their rooms—even rugs and window curtains.

"Only one thing they never carry off," he added, "and that's the Gideon Bibles. I used to think they swiped them but I (*Continued on page* 68)

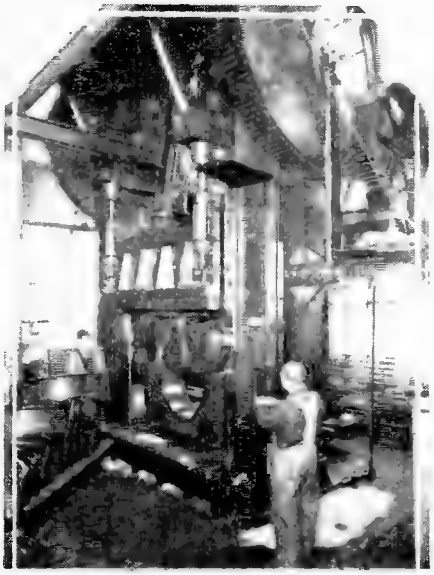
The Giants of Industry

By J. Kay London



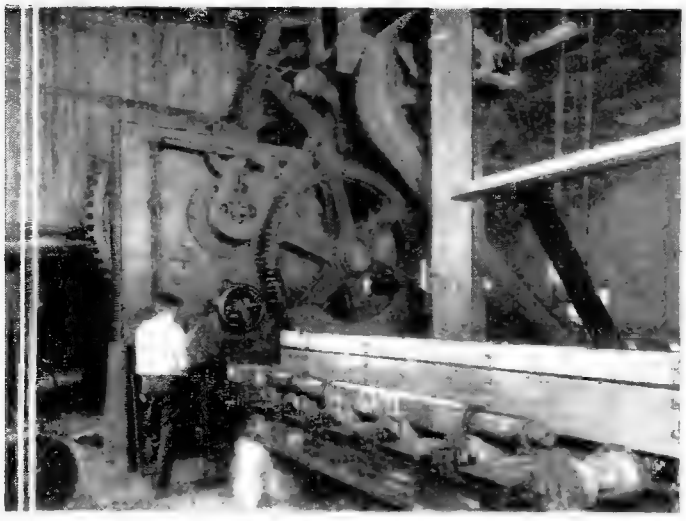
Photo—E. W. Bliss & Co.

A triple-geared, twin-driven toggle drawing press making heater fire pots.



Photo—E. W. Bliss & Co.

A drawing press producing a pressure of 400 tons making auto fenders.



Photo—Henry Pels & Co.

A machine that will shear round billets up to 7⅝ inches and square billets up to 7⅛ inches in operation.

Photo—Henry Pels & Co.

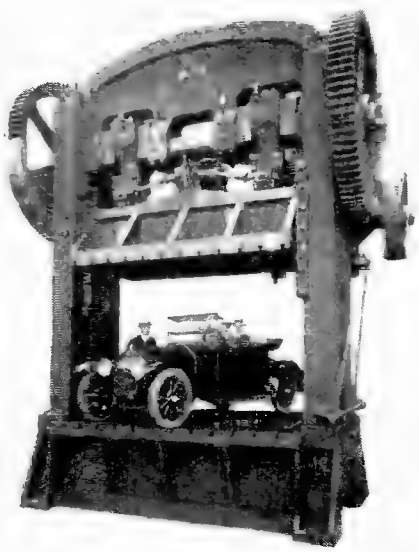
This press develops a pressure of 660 tons and is used for stampings of all kinds and trimming heavy forgings.

Photo—International Harvester Co.

A drop-forge hammer capable of striking a blow of from 10,000 to 12,000 pounds, forging a crankshaft.

MACHINERY replaces man power. This, after all, is a machine age, but one must remember that for every machine that is manufactured, hundreds of men are employed in the building of that machine and in the design of its component parts. Yet, are there any amongst us who believe that we could do the work of some of the giants of industry? Let us take, for example, some of the large presses, power shears, and drop-forge hammers. Even Vulcan himself could not be given credit for striking a blow of 12,000 pounds or for exerting a pressure of 1,500 tons.

On this page there is shown a machine for cutting billets. It has a knife five inches thick, made of high-grade tool steel, and it will bite off a piece of round rolled steel billet up to 7⅝ inches in diameter with a knife that exerts a pressure of about 1,300 tons. Now compare the gigantic press for making car ends, shown with the occupants in a motor car on the bed of the press, and then imagine if any of the giants of mythology could duplicate in fable the results that these giants daily produce. The motors operating them vary from 40 to 100 horsepower and the pressures from 800,000 to 3,000,000 pounds.



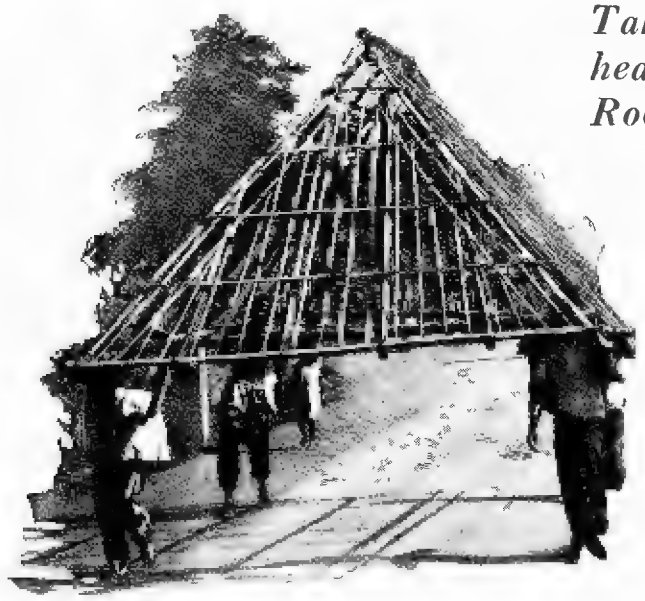
Photo—E. W. Bliss & Co.

This giant press, capable of exerting a pressure of 1,500 tons, is used for stamping out freight-car ends.

Does Your Home Need

Take It From S. Gordon Taylor—There Is Roof of Your Home. . . . Read His Views head Is Likely to Assay Almost Clear Profit; Roofing—and Start to

By S. Gordon Taylor



Our Filipino cousins make the roof of their homes first and then transport it to the site where the home is to be built. We could do much worse than give the roofs of our homes first consideration instead of last. (Ewing Galloway.)

AT the head of this article you'll find a picture illustrating the Filipino maxim for home-builders: *Always start with the roof.*

The Filipino way of working is to construct the roof first of all and then to carry it to the home-site. That's how important the roof of the home is to our island cousins.

And it might be better in a good many cases if we'd take a leaf from the island cousins' book. It might be better if *we'd* think of the roof first, for by thinking of it last we sometimes get a very dubious covering for our heads, health, and possessions.

We are too apt to regard the roof of our home as a permanent feature. Rarely is this feeling warranted by the facts. . . . A recent study of the roofing market indicates that 60 to 80 per cent of all roofing sold is destined for replacement purposes, and that the average life of a roof is only fifteen years.

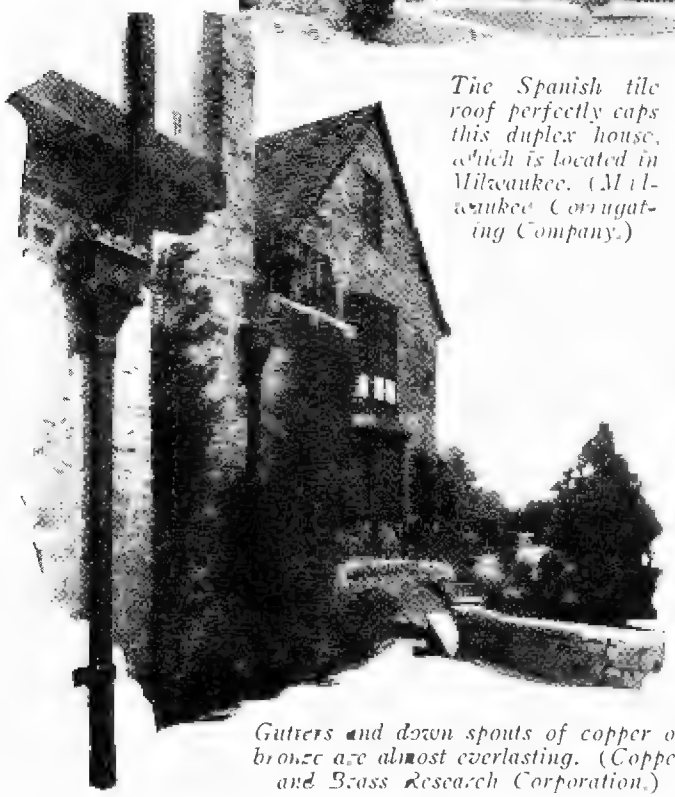
When a roof reaches the end of its efficient life, it requires replacement immediately. Delay means not only discomfort, but damage to interior finish and household goods. The result too often is a hurried selection of materials and a hurried application of those materials to their purpose. Under these conditions, a satisfactory roofing job is hardly possible.

The home-owner who wants his next roof to be right in every particular will study the subject before his present roof reaches the stage for emergency measures. When the time comes for re-roofing, he will be fully decided on the type of cover that best suits his needs.

There are four primary considerations in selecting the roofing for a home. First there is the factor of protection from the elements which, of course, is the basic function of a roof. Almost any roofing material can be depended upon to shed water but an extremely important question is how long it will continue to do so. This brings up the second consideration which is that of long life. The third feature for consideration is economy and finally there is the matter of appearance.

The waterproof quality of a roof depends upon more than the surface roofing material alone. The roofing may shed water perfectly, yet it will not be effective unless proper

The Spanish tile roof perfectly caps this duplex house, which is located in Milwaukee. (Milwaukee Corrugating Company.)



Gutters and down spouts of copper or bronze are almost everlasting. (Copper and Brass Research Corporation.)

PRIZE COMPETITION

$400 in Cash Awards for the 18 Best Answers on—

How I Would Utilize Waste Basement Space

Open to All Readers. See Page 63 for Details

an UMBRELLA?

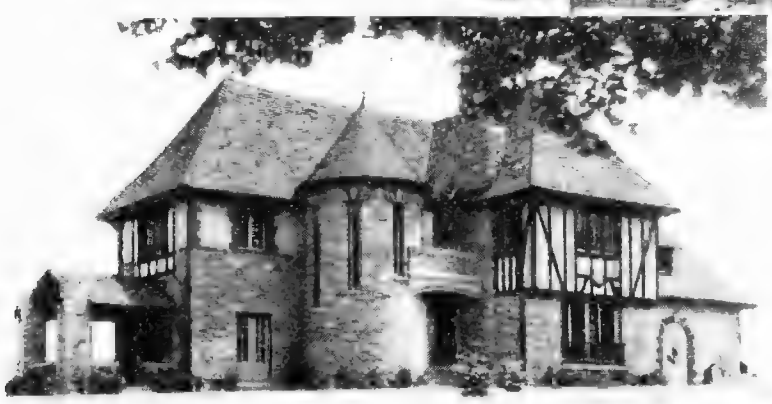
One Place Where Over- and that Place Is on the on the Subject of Good Profit Now

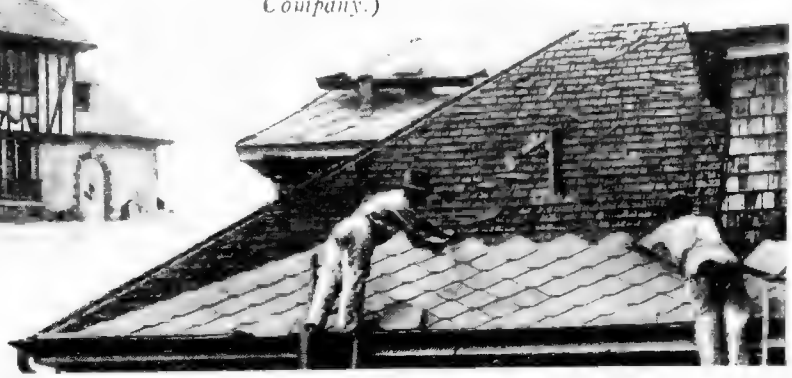
provision is made in the form of adequate flashings, gutters and downspouts to carry off the drainage. In modern homes copper and brass are being used very extensively for the flashing around the base of chimneys, dormer windows, and other structures protruding from the roof. Also, for valleys, gutters and downspouts. The reason for this is that copper has almost infinite life even on exposed areas such as roofs, and further, particularly in the case of gutters and downspouts, is itself attractive in appearance and does not require any painting or other maintenance attention. Freedom from deterioration and leakage is particularly important in the roof flashings because a large portion of the flashings are concealed under the main surface material and if the flashing becomes defective it is frequently a difficult matter to locate the source of the trouble. Also, replacement of flashings requires dismantling a good part of the roof and is likely to be an expensive operation.

As for protection against heat and cold the surface roofing material plays a comparatively small part, even when laid over wood sheathing. In winter a good part of the heat losses occur through the roof and the proper roof insulation is therefore doubly important. This can best be provided by installing a layer of insulation material. This may go between the sheathing and roofing, under the sheathing or on the under side of the rafters. The last of these three is the (*Continued on page 70*)

This house doesn't actually need an umbrella. It's shingled in lasting, varicolored asphalt. (Certainteed Products Corp.

Shingles of mineral-covered asphalt provide rough and ready charm. (Flintkote Company.)





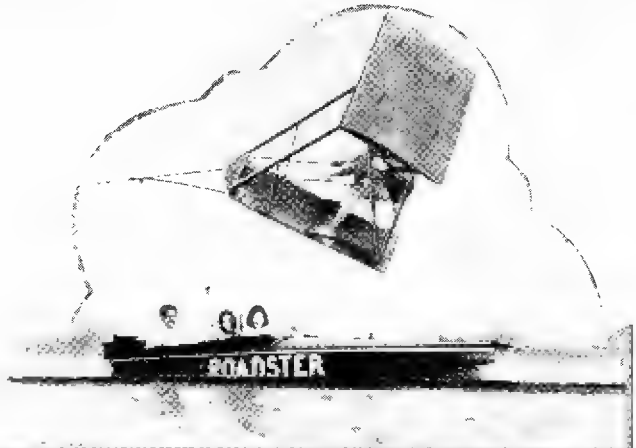
The roof above is of rock-like shale tile. The picture to the right shows how new roofing materials can be applied over the old roof. (Ludowici-Celadon Company; Johns-Manville Company.)

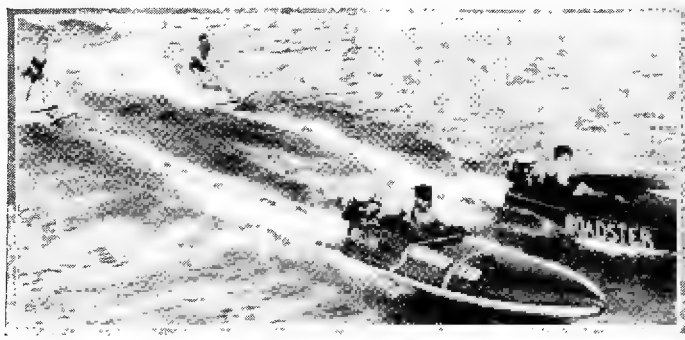
Mr. Home Owner

On page 84 SCIENCE AND INVENTION offers a new service which will be of inestimable value to readers who are home owners or some day hope to build or buy their own homes. Through this service a vast fund of information on building materials and equipment is yours for the asking.

"Outboard Busters"

Broncho Wrangling Is Tame in Comparison with Outboard Busting, a New Sport for Marine Acrobats





Aqua-skiing takes the place of aqua-planing in Florida now. The skiers make their leaps from a spring-board in the water.

Water skiing is full of spills. In another moment this jumper will not land on the skis. Top: An aqua-glider doing his stuff.

SPEEDY outboard motorboats are now being put through antics that would make even an experienced broncho buster look upon them with envy. With aquaplanes flying through the air; with riders skiing at forty or more miles an hour behind fast outboard motor craft; with humans serving as hurdles; and with motorboats that actually take to the air from a raised platform, one can imagine the difficulty a cowboy would have in attempting to duplicate the effect on land.

Even noted society girls have taken to the sport of racing these tiny speed boats in a series of events in the Deauville Pool at Miami Beach, Florida. The confines of this pool are rather narrow, but the society jockeys find great delight in taxiing their vessels to position and opening the motor fully at the sound of the gun. One of the photographs on this page shows such a racing event in progress.

At Winterhaven, Florida, several new sports have been evolved. One of these is aqua-gliding and the second aqua-skiing. The former requires an ordinary aquaplane to which a small glider has been rigged. The wing of the glider is not large enough to keep the occupant in the air, but it does present enough of a resistance to create many thrills, a few spills, and to induce excitement in the crowds watching the aqua-glider go through his stunts. The device is the invention of Harrison Frazer, who has been noted for his outboard achievements.

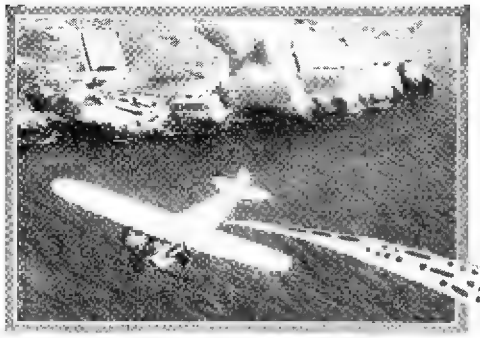
Breaking his own speed record, Philip Turner sent his 47-pound outboard motorboat along at a speed of 55.76 miles an hour.

Society jockeys racing their outboard motor craft in the narrow confines of the Deauville Pool, Miami Beach, Florida.

Aqua-skiing is different from aquaplaning in that the riders equip themselves with a pair of skis which are towed by boats driven with outboard motors. It requires more skill to operate the aqua-skis than is necessitated in aquaplaning. Devotees of this ski sport have erected a spring-board which is held up by a swimmer. As the outboard motorboat rushes by the spring-board, the skier guides his direction toward the board and leaps into the air. It requires more than unusual skill to land on the skis.

It is quite difficult to balance an outboard motorboat when it is flying through the air, and flops are frequent.

Similar spring-boards are also used to catapult such motorboats as the *Flying Rug* into space. Careful balancing is necessary to prevent a nose-dive or a side slip. Recently Philip Turner, a famous racing motorist, set a new world's outboard motorboat speed record of 55.76 miles per hour on the river Thames.



Air Lanes of Dots and Dashes

From Miami to Havana and along the South American Coast Telegraphic Code Messages from Land Stations Guide Giant Air-Liners Safely into Port.

By George R. Brown

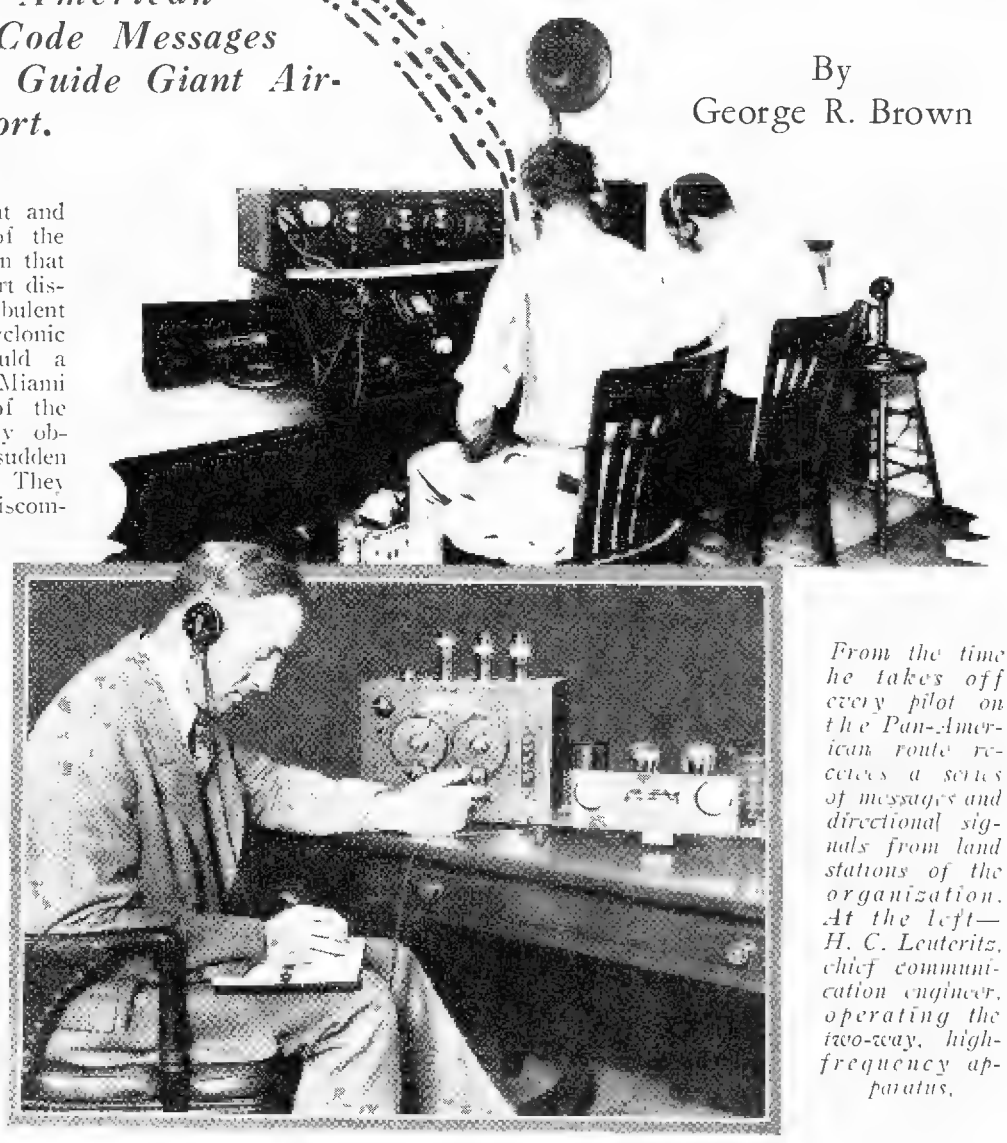
THE morning dawned bright and clear in Havana. None of the American pleasure-seekers in that great Cuban city knew that a short distance from land on the turbulent waters of the South Atlantic, a cyclonic storm was brewing. Nor could a group of travelers bound for Miami in a huge tri-motored plane of the Pan-American Airways find any obvious reason for their pilot's sudden about-face back to Havana. They thought only of the delay and discomfort; they could see no storm. But the pilot of that huge ship heard a stream of wireless waves which brought to him warning of impending danger. He knew that twenty-eight land stations of this great aerial transportation system were at that moment pounding brass in order that he and several other pilots might not venture into the teeth of a turbulent storm. He knew that at the touch of a key his radio operator could secure for him the latest weather reports and even check up on his position. Without that key he would be flying in uncertainty; he might know of no storm; he could not tell his position if any unforeseen accident should occur.

Of course the pilot might have fought his way through the storm successfully. But that introduces the element of chance to a very great degree. That, according to the Pan-American Airways, is the factor that they are seeking to remove, and so they have insisted on providing all their planes on all their routes with adequate radio communication apparatus in an effort to make aerial travel dependable.

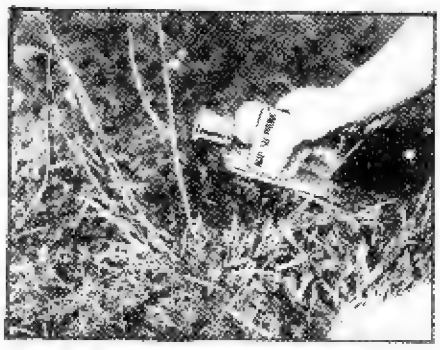
This company's ideas of reliable apparatus did not include manufactured sets which were available. A communication department was organized under the direction of H. C. Leuteritz as Chief Communication Engineer. After careful research amid the technical snarls surrounding the efficiency of radio communication with planes, a receiver and transmitter were designed which have proved their capabilities under the trying tests of fog, storms and damaged navigating apparatus.

The apparatus has been primarily designed for transmission and reception of telegraphy by continuous waves, but it can be adapted for telephony. The entire installation is mounted within reach of the radio operator and is directly controlled, thus taking full advantage of the flexibility and wave length range of the equipment with maximum simplicity in circuit design.

The transmitter employs a master oscillator neutralized power amplifier circuit using two UX 210 tubes and is capable of furnishing from 10 to 25 watts of unmodulated radio frequency energy to the antenna. Plug-in coils are used in order that operation may be obtained on wavelengths of 32.4, 52.8, 600 and 900 meters. Power is supplied by a small dynamotor, mounted in the plane, entirely enclosed to protect (*Continued on page 67*)

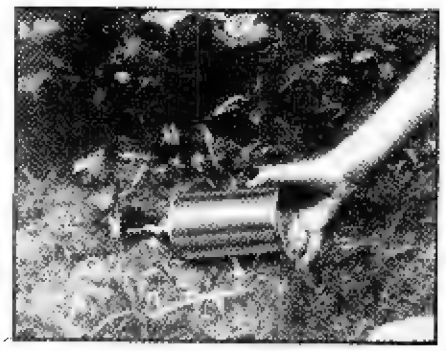


From the time he takes off every pilot on the Pan-American route receives a series of messages and directional signals from land stations of the organization. At the left—H. C. Leuteritz, chief communication engineer, operating the two-way, high-frequency apparatus.



One will go to extremes to rid his lawn of crab grass. Here is one way to do it. Pour a dessertspoonful of strong sulphuric acid on the crown of the plant.

You can add a pinch of the chemical mixture directly to the soil, if desired. Work in and loosen the soil with a fork.



A can with an oiler-spout can be used for treating spindly young plants with the liquid fertilizer.

Feed *Your* Plants *with* Chemicals

By Raymond B. Wailes

"HOW about some nitrogen? Have you any phosphorus cakes? Gee, I wish I had a dish of potash! I like my food seasoned with zinc and manganese."

If your plants could talk, they would say just such things as these. And why wouldn't they—with nothing but water to help them grow? We ourselves cannot exist on an unbalanced diet. Why then feed our plants as we would not feed ourselves? Why not balance *their* "diet"?

One can make a balanced fertilizer for house plants and garden flowers by mixing sodium nitrate, 1½ lbs; sodium phosphate (tertiary) 1 lb; and potassium sulphate 1 lb. The powdered chemicals, which are not at all harmful, are mixed well and stored in an airtight jar for use throughout the season. For liquid fertilizer, take a rounded tablespoonful of the mixture and dissolve it in a gallon of water. This solution is used directly upon plants once a week. It should not be sprinkled on the foliage. The liquid is odorless, colorless and balanced as to the needs of plants. One may stir a pinch of the mixed chemicals into the soil around the plant. For house plants an old kitchen fork makes a good cultivator for this purpose.

Here's a month's "dose" of home-made fertilizer.

One tablespoonful of three inexpensive chemicals mixed makes a gallon of odorless, safe fertilizer.

Urea is a white crystalline chemical which can be used for plants both indoors and out. The price of this substance at wholesale sources is about sixty cents a pound, and it provides growing things with the substance which most of them lack—nitrogen. It is applied at the rate of a teaspoonful to nine square feet of growing area, or a small pinch to a potted plant. It can be scattered over the plot in the dry condition, mixed with finely powdered dry earth to spread it evenly; then the covered area is watered. Or, it may be dissolved in water and used directly.

Sodium nitrate is another chemical which can be used to supply nitrogen to the soil. One tablespoonful dissolved in two or three gallons of water will prove itself a valuable liquid fertilizer. It can be applied to plants which have just been watered without burning their roots if the suggested solution is used.

Sodium nitrate can also be used on trees and shrubs showing a lack of nitrogen foods. Deficiency of nitrogen in springtime is usually shown by a yellowish hue in the soil or in the newly sprouted leaves, and later by the dwarfed character of the plant. A quarter-pound of sodium nitrate for every year of the tree's age should be worked into the soil or dissolved in some water and applied to the ground.

The potassium or "potash" content of wood ashes provides potassium for the plant. Soapsuds and dishwater also have been applied as fertilizer. When soaps were made from wood ashes or caustic potash, this was a wise thing to do; but now, when caustic soda is used, the dishwater might do more harm than good.

The majority of soils can do without lime. It is used mainly because it is alkaline in the presence of moisture and supplies calcium to the soil. But practically all soils contain sufficient calcium for plant needs. Weeds love alkaline soils and any application of lime promotes their growth. On lawns, lime should never be applied. Crab grass will increase itself bountifully when lime is applied, and acid—and alkaline—tolerant grasses lose out in their struggle for supremacy of the lawn.

Ammonium sulphate gives an acid reaction in the presence of water and will be found very good in lessening the growth of weeds. The right mixture is five pounds of ammonium sulphate to ten gallons of water per thousand square feet of lawn surace. Watering the lawn after sprinkling will help the chemical penetrate the soil. In applying the dry chemical, five pounds can be mixed with sand and broadcast over the area: a good soaking should follow. One very good method of keeping the quantity right is to take the garden hose and shape it on the lawn to form a square fifteen by fifteen feet, and apply one pound of the ammonium nitrate, mixed with sand, to this specific area. Several applications should be given at intervals of two or *(Continued on page 65)*

Gunning *for* Lightning

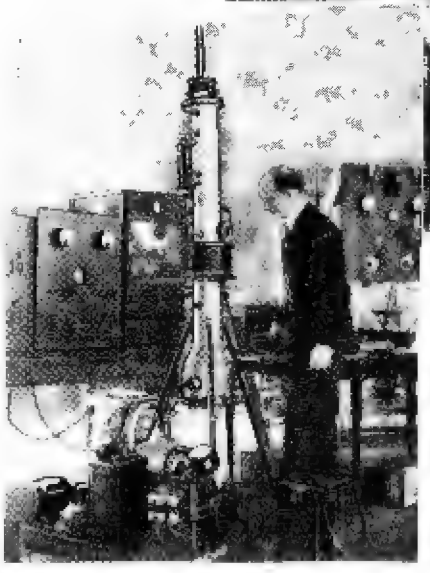
By J. N. Wirt

This mobile generator can impress surges of more than 1,000,000 volts on a transmission line.

EQUIPPED with the latest type of Norinder-Du Four cathode-ray oscillographs, Westinghouse engineers carry on a continuous investigation of the effects of lightning on power transmission lines. These special oscillographs act even faster than lightning and are capable of accurately recording every detail of a lightning flash, including the polarity, voltage, and time required for the voltage to rise and fall. They have been installed in field experimental stations scattered throughout the lightning-infested areas of Illinois, Tennessee, West Virginia and New Jersey. A portable lightning laboratory is used to study lightning disturbances on a ten-mile section of a 220 kv. transmission line.

Many new electrical features are incorporated in the design of the new oscillograph. This instrument can be readily changed from a laboratory instrument to a type which, when connected to a transmission line, will automatically record the complete story of a lightning shock in terms of millions of volts and millionths of a second.

A typical lightning flash.



The elements that work together to insure clear photographic records are an electron filter, which removes the slow moving electrons that tend to fog the film, and an improved method of magnetic focusing of the beam.

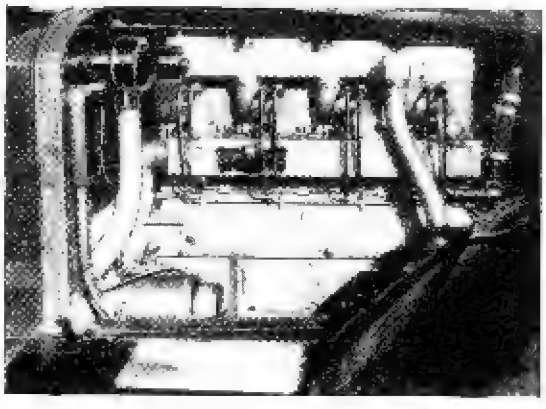
A surge generator, capable of delivering a million volts, is used in conjunction with the tests, so that artificial transients may be studied

The latest type of Norinder oscillograph works faster than lightning itself.

Diesel Car Makes Debut

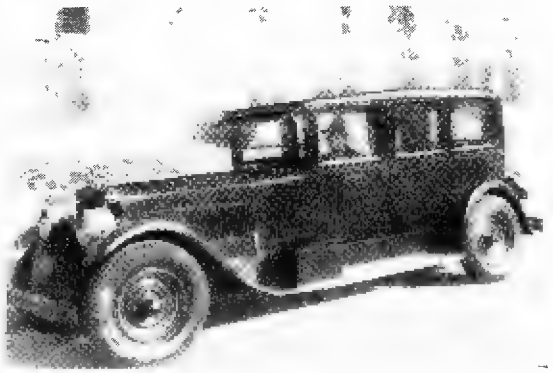
By A. E. LeBlanc

TRUCK, bus, and tractor users soon may be operating units equipped with Diesel engines. Outstanding economy and practicability for commercial haulage were definitely demonstrated by a Diesel powerplant installed in a large motor car on a trip of 2,500 miles made early this year.



A standard Model U Cummins engine was used in the demonstration drive.

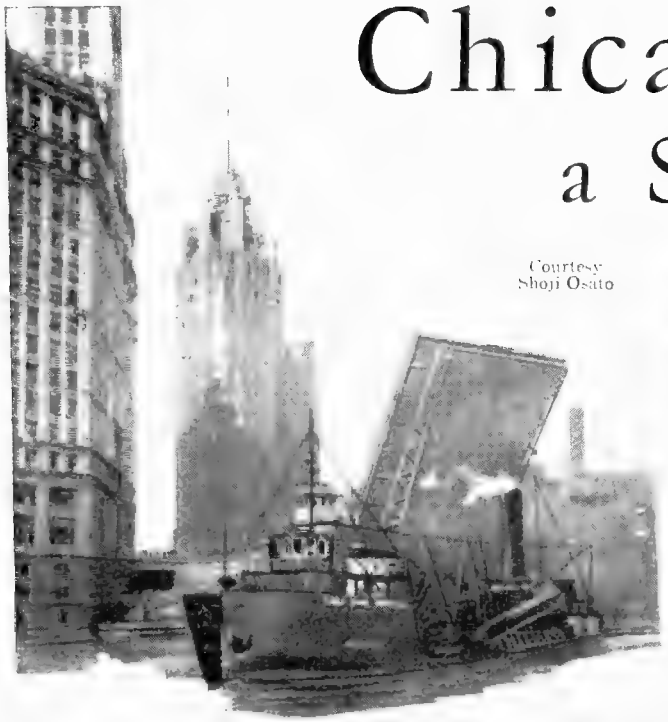
Fuel cost per mile for the Diesel-powered car came to about one-thirteenth of that for the vehicle as originally equipped. The gasoline motor burned fuel costing about 21 cents per gallon at the point where the Diesel installation was made, and turned up from six to eight miles per gallon on the road. Though the Diesel motor added 600 pounds to the weight of the car, it delivered about 26 miles per gallon of fuel consumed, and the fuel cost at the point of installation came to but 4¾ cents per gallon.



C. L. Cummins piloted the Dieselized Car over its 2,500-mile course.

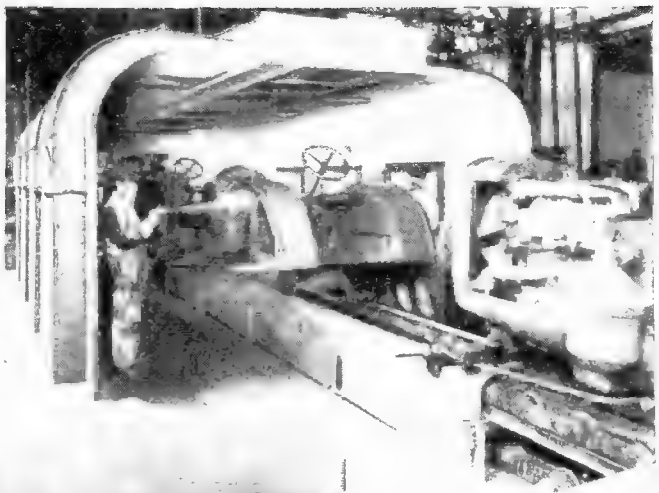
The Diesel motor was a standard Model U manufactured by the Cummins Engine *(Continued on page 68)*

Chicago — a Scientific Glimpse



Courtesy Shoji Osato

Almost at the foot of the great Tribune Tower a bridge parts and rises to admit steamers of various types from Lake Michigan, which lies at Chicago's door. The Tribune Tower is one of the most interesting adaptations of the Gothic to the skyscraper form.



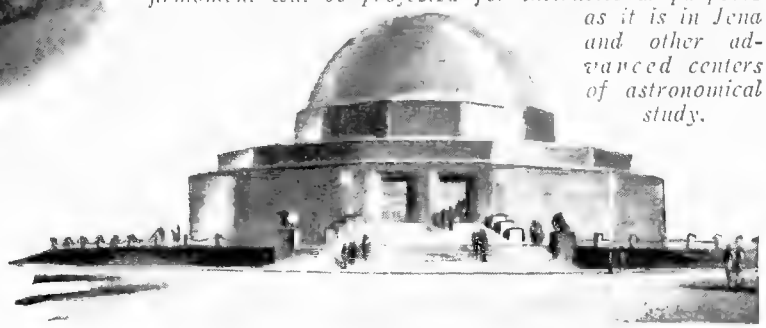
The International Harvester Company's range of products embraces farm implements, from the simplest ploughs to the complex "combine." The picture above shows a workman spraying an International tractor with paint on the continuous assembly line.... The picture below is of the Merchandise Mart, the largest building for merchandise display in the world.

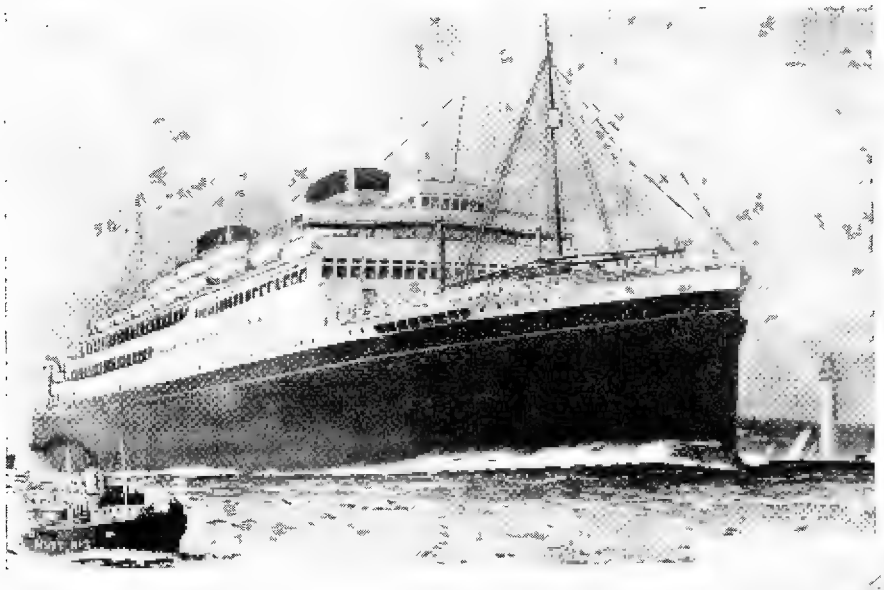
Chicago Aerial Surveys Company

This night view of Chicago features in the foreground the tower of the Wrigley Building, while beyond can be discerned Wacker Drive, one of the most unique boulevard construction projects in the world.... On the left is an aerial idea of the task involved in taking the kinks out of the Chicago River—the old course of the river is to the left, the new one to the right.

The new Shedd Aquarium adds another repository of living scientific knowledge to the Field Museum and other distinguished achievements of this type. The water for the aquatic creatures in this aquarium is to be conditioned to their needs as air is conditioned for human needs in theaters and auditoriums.

In Chicago's Adler Planetarium a representation of the firmament will be projected for instructional purposes as it is in Jena and other advanced centers of astronomical study.





The White Star Line's Britannic is the largest motor-driven liner in the world.

TWELVE motor cars could be parked within the area of the bedplate of one of the motors. By removing an inlet valve an engineer can climb bodily into one of the cylinders. . . . Daily consumption of fuel oil, 80 tons. Each inlet, exhaust, and fuel valve will function 70,000 times. Each piston will travel a distance of 280 miles. . . . Thirteen thousand tons of water will pass through the cylinder jackets, and 16,000 tons of seawater will circulate through the various coolers. . . . Exhaust gas will generate steam at 100 pounds' pressure for ship use . . . The Britannic's motors can be reversed in nine seconds.

We'll Motor Across *the* Atlantic

Displacement of Steam-driven Liners by Dieselized Ocean Motor Ships Forecast by Construction of M. S. Britannic

By Marguerite Kujawska

THE tourist of the future will be carried across the Atlantic by the same kind of powerplant that whisks him along the Lincoln Highway at the present time. This is the probability that has been given vastly increased support by the construction of the White Star's Britannic, largest motorship in the world.

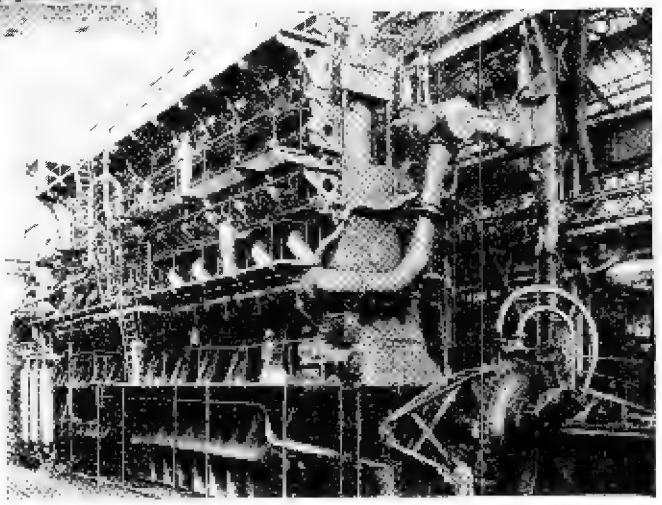
Fifteen hundred and fifty passengers are provided for in the new motorship, which will be placed in the New York-Liverpool service of the line, and the luxury of the accommodations will be surpassing.

The Britannic is 680 feet long, 82 feet in breadth, and 43 feet 9 inches deep. Her gross tonnage is 27,840. Thus she compares well in size with such liners as the Belgenland. Two ten-cylinder double-acting Diesel engines—the largest and most powerful ever installed in any vehicle—will drive her through the deep.

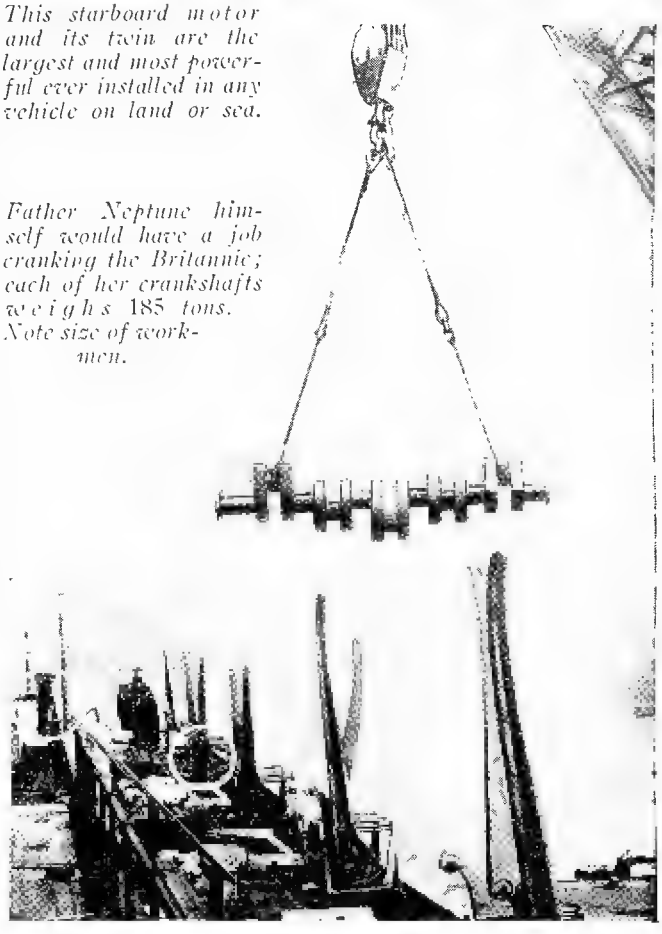
To supply air for starting and fuel injection, and also for actuating the machinery for maneuvering the ship, the Britannic is equipped with four compressors, each driven by a four-cylinder motor of the Diesel type. For emergency, a small steam-driven compressor is included. Four other Diesels—six-cylinder units—will drive generators which will furnish electrical current for engineroom and general ship use, and there is an emergency generator, also Diesel-driven, above the margin line. The combined capacity of the four generator sets for regular duty is 2,000 kilowatts, and that of the emergency set is 75.

The connected load of current in the Britannic will be equivalent to that required for a town of 30,000 people. Nearly 200 electric motors, ranging in horsepower from one to 170, are included.

Steam for ship use at sea will be generated in four boilers fired by exhaust gas from the propulsion motors. Gas from the auxiliary motors will fire one boiler to furnish steam for heating and cooking, and two oil-fired boilers will also be available.



This starboard motor and its twin are the largest and most powerful ever installed in any vehicle on land or sea.



Father Neptune himself would have a job cranking the Britannic; each of her crankshafts weighs 185 tons. Note size of workmen.

The Big Bridges Rise

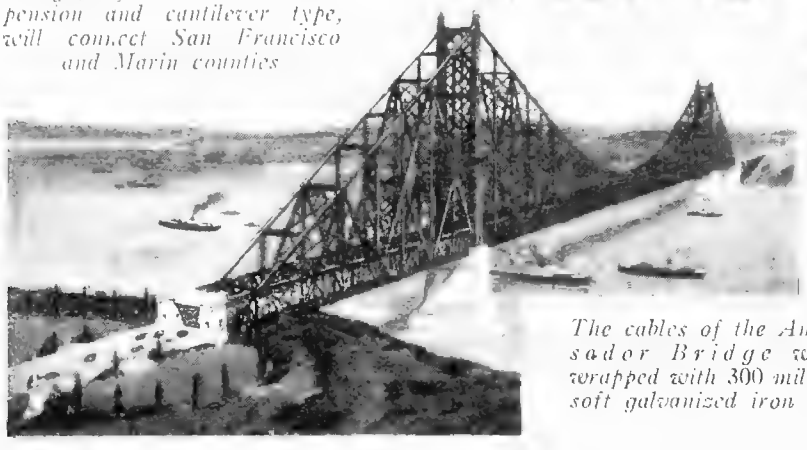
$60,000,000 will be the cost of the proposed Liberty Bridge, which will span the Narrows and link Brooklyn with Staten Island. The towers will be 800 feet high—taller than the Woolworth Building—and the main span 4,500 feet long—1,000 feet longer than that of the Hudson Bridge. Original features will be a carillon of bells and a beacon light. (Robinson and Steinman, Engineers.)

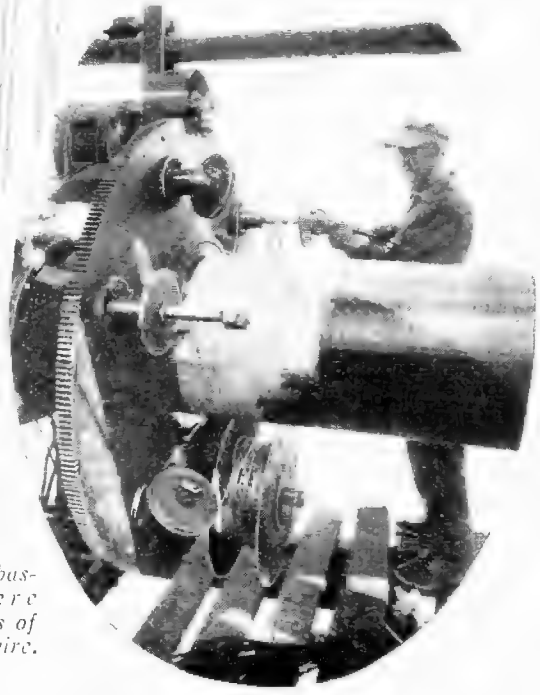
An idea of the height of the Hudson Bridge across the Hudson River at New York City, is shown in this downward shot of an arch under construction.

Across the rivers and harbors of the world man throws his expert webs of steel. . . . Once a tremendous task, conceived in trepidation and watched with wonder, the construction of a suspension bridge has become a systematized process, progressing from stage to stage with orderly regularity. . . . Yet can any appearance of order and system overcome the element of the marvelous in the spectacle of matter-of-fact men laboring on swaying catwalks in a high wind, weaving shore to shore?

Connecting Detroit with the Border Cities, Ontario, is the Ambassador Bridge, with a span between towers of 1,850 feet—at present the longest in the world. The mid-span clearance is 152 feet—more by 20 feet than that needed for any vessel now plying the Great Lakes.

The proposed Golden Gate Bridge, of combination suspension and cantilever type, will connect San Francisco and Marin counties





The cables of the Ambassador Bridge were wrapped with 300 miles of soft galvanized iron wire.

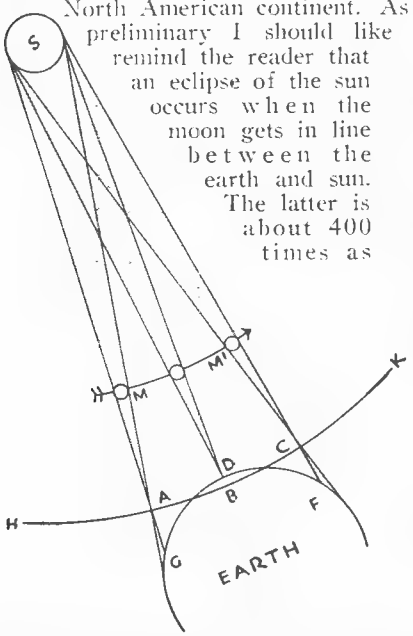
Get Out Your Smoked Glasses

When the moon intercepts the light from the sun, the sun may look as it does in this photograph. The sun is much larger than the moon, but also much farther away, so the latter can hide the sun.

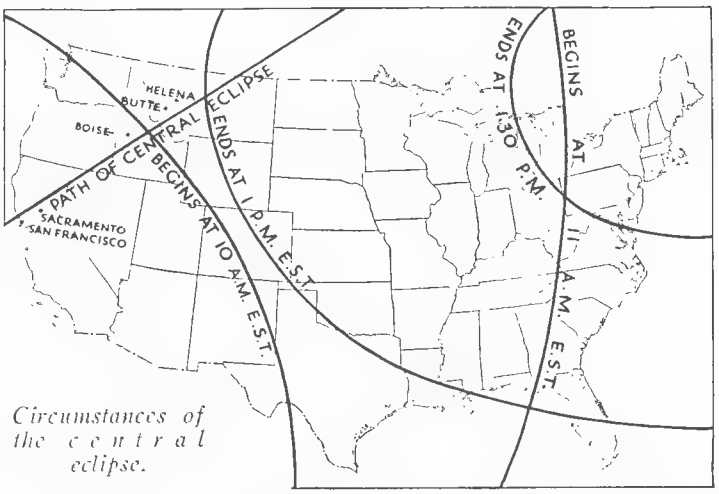
By Donald H. Menzel, Ph. D.

Lick Observatory

ON the 28th of April will occur an eclipse of the sun, visible generally as a partial eclipse throughout the North American continent. As a preliminary I should like to remind the reader that an eclipse of the sun occurs when the moon gets in line between the earth and sun. The latter is about 400 times as large as the moon, but since it is 400 times farther away, the two objects appear to be about the same size in the sky. The lunar orbit is far from circular. When the moon is nearer than the average its disk is larger than the sun's and a *total eclipse* will occur when the two bodies come exactly into line with the earth. When the moon is farther away than usual, it will not be able to cover the sun completely and the eclipse will be *annular* or ring-like.



The conditions that obtain on April 28 are schematically indicated in the diagram here, not drawn to scale.



Circumstances of the central eclipse.

The April 1930 eclipse is a sort of freak because it is total, annular, or partial—according to the place it is viewed from. The moon and sun are so nearly the same size that the curvature of the earth is the factor that decides which appears to be the larger. Figure 1 is a schematic diagram (not to scale) of the condition that obtain at that time. (*Continued on page* 60)

"Both Ends of the String"

By Augustus Post *and* Arthur H. Lynch

Aviation Editor *Editorial Director*

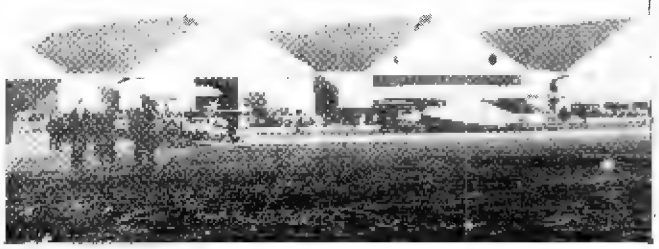
Says Mr. Post—

Early in the Spring of 1908 a few of the members of the Aero Club of America who had been studying the subject of gliding, decided to make some real experiments and to build gliders after the model of those constructed by Octave Chanute, an engineer who lived in Chicago, and who was one of the authorities on Aeronautics at that time. We were fascinated (*Continued on page* 60)

THE staff of SCIENCE AND INVENTION is connected with glider progress in America at "both ends of the string." In Augustus Post, Aviation Editor, it has an active glider experimenter of the days when gliding was a field containing far more unknown than known quantities. Arthur H. Lynch, Editorial Director, is a glider enthusiast and a flier of motorless ships as they are today. He made the first paid-for glider flight taken at Roosevelt Field. In connection with the pictures published with this article, Mr. Post and Mr. Lynch offer illuminating comments.

When Mr. Post (on the right) took to gliding in 1908, he galloped down a slope and was wafted aloft in this glorified boxkite—

While Mr. Lynch gets a shock-cord start and does his motorless flying sitting down.



On The Short Waves *with a* Super-Wasp

You Won't Have a Thrill in Radio Until You Play Around with the High Frequencies

By Robert Hertzberg

The Super-Wasp in a radio transmitting station. This is W2XCT, the television station of the Pilot Radio & Tube Corporation.

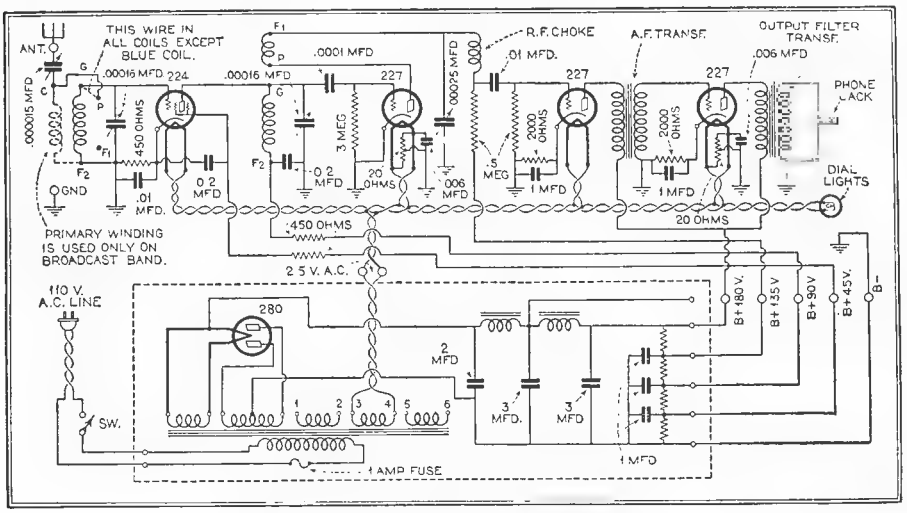
THERE is nothing in radio more thrilling than the short waves. Radio fans who have constructed the most expensive and complicated of broadcast receivers and who think there is nothing left in the "game" to interest them are discovering a new and fertile field of amusement in the regions below 200 meters, where hundreds of stations are now broadcasting at all hours of the day and night. Short waves have the peculiar habit of "skipping" over the earth's surface in such irregular fashion that even tiny transmitters deliver wallopingly strong signals at antipodal points, and owners of short-wave receivers enjoy truly phenomenal reception.

The writer wishes to distinguish between short-wave broadcasting and short-wave amateur telegraphy. The former is a comparatively recent development and is of interest to broadcast fans because the announcements are made in *voice*. Amateurs have been telegraphing to each other all over the world for many years, but this work is done in the dots and dashes of the Continental Code. It is much more difficult to pick up a distant short-wave *broadcast* station than a *telegraph* station, and therein lies most of the sport. If such reception were easy there would be no "kick" to it.

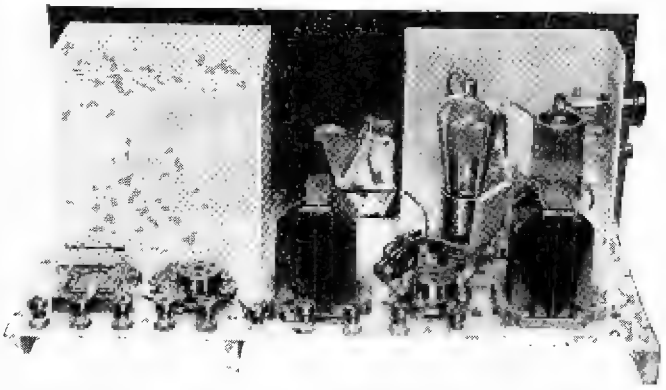
It is still an accomplishment, even in these days of high-power stations and super-sensitive receivers, for a man in New York to hear West Coast broadcasting direct, even on a seven or eight-tube receiver. The New York owner of a good short-wave receiver using only three or four tubes considers W6XN, in Oakland, California, a nuisance because of its strength, and reaches for Khabarovsk, Siberia, where the Soviet maintains a fine short-wave station, or for Bandoeng, on the island of Java, where the enterprising Dutch operate a whole string of short-wave transmitters. Thousands of fans who have "discovered" the short wave amuse their friends by tuning in, on the loud speaker, mind you, station G5SW, in Chelmsford, England, which signs off at seven o'clock in the evening, New York time, by broadcasting the midnight chimes from Big Ben in London; or station PCJ, Holland, from which the announcements are made in six languages; or little NRH, in Costa Rica, Central America, over which the owner broadcasts the chirpings of his delightful two-year-old baby; or station VK2ME, in Sydney, Australia, which broadcasts football games in the best McNamee manner.

In a spirit of truthfulness, the writer does not want to create the impression that such reception can be accomplished at the mere flip of a switch. Short-wave work is still quite tricky, and it takes a few hours of practice to learn where the important stations come in on the dials. The usual difficulties with fading and signal distortion are experienced, but the short-wave channels are so active now that distant stations can be heard almost any time. The Australian, Javanese and other East Indian stations float in early in the morning, conveniently around breakfast time. The Dutch, English, French and German stations operate right through the afternoon. The Central American and South American stations put on special programs for the United States during the early evening hours, as do the Dutch stations. There are also plenty of American transmitters. To take

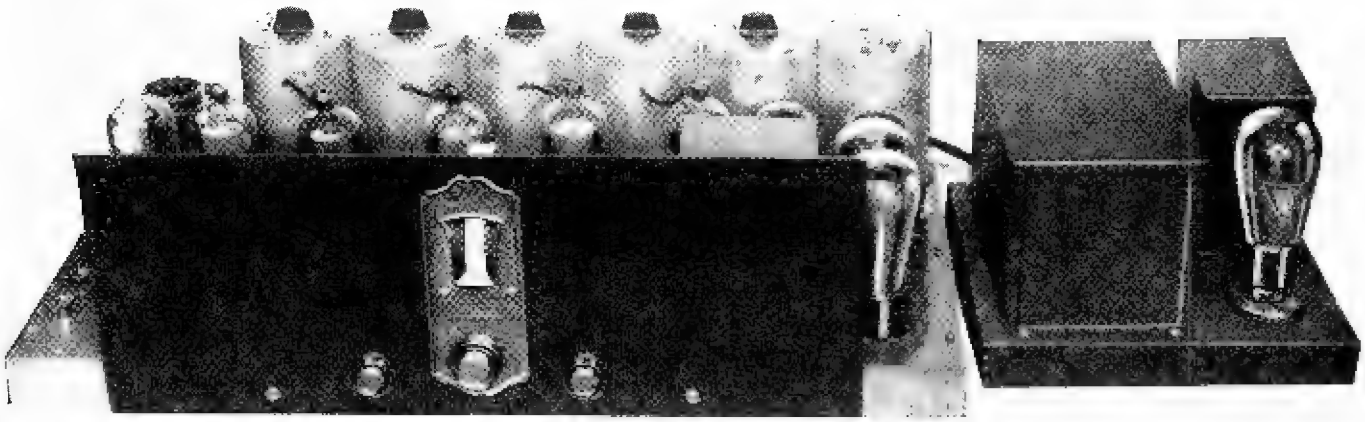
(*Continued on page 69*)



The circuit of the AC Super-Wasp employs a -24 tube for the tuned r. f. stage, and three -27 tubes for detector and audio stages.



Compact and well shielded is this efficient set with all parts cleanly mounted on baseboard.



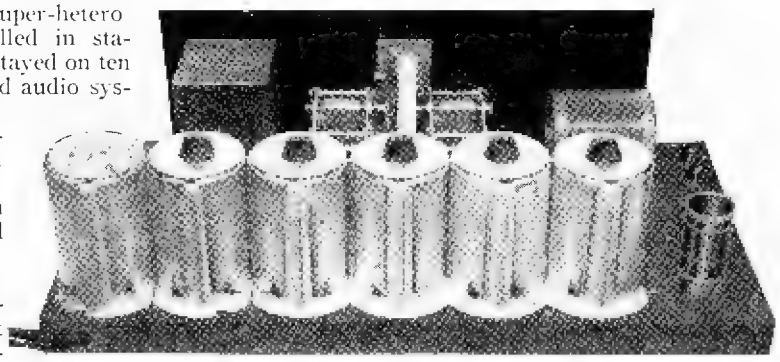
The Lincoln Super with power pack to the right.

Pull Them In *with a* Heterodyne

If You're Interested in Broadcast Reception, Here Is a Set Which Will Bring in Stations with a Bang.

By George R. Brown

IF you knew of a super-heterodyne set which pulled in stations without peaking, stayed on ten kilocycles, and had good audio system, you'd probably be interested in it—provided you played around with super-heterodyne circuits in the radio days beyond recall.



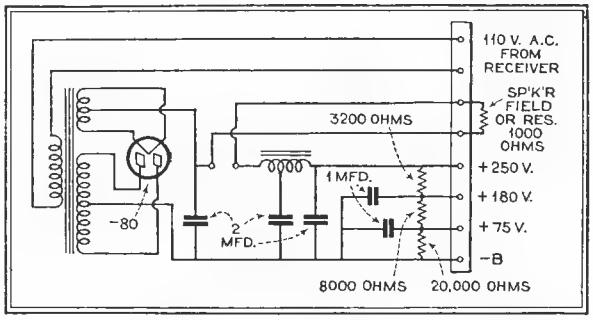
Here is the Lincoln Super from the rear. It is a well-designed set and compact in spite of its eleven tubes.

The Lincoln Super-Heterodyne is a set which has these qualifications. We know. We've tried it out. We sat in a room in a house eight miles out of New York and logged stations that are the despair of every radio owner in the metropolitan area. We played around with the dial and went right up the scale, stopping only long enough to hear call letters and incidental announcements. We listened to a total of thirty stations—only three of them local. We even got as far as Havana and pulled in KHJ in Los Angeles without batting an eye. . . .

We were interested very greatly in this hook-up, and knowing that the readers of SCIENCE AND INVENTION would be interested in an explanation, we obtained the following information from W. H. Hollister of Lincoln Radio Company concerning the intermediate frequency amplifying transformers, which are the important part of this set.

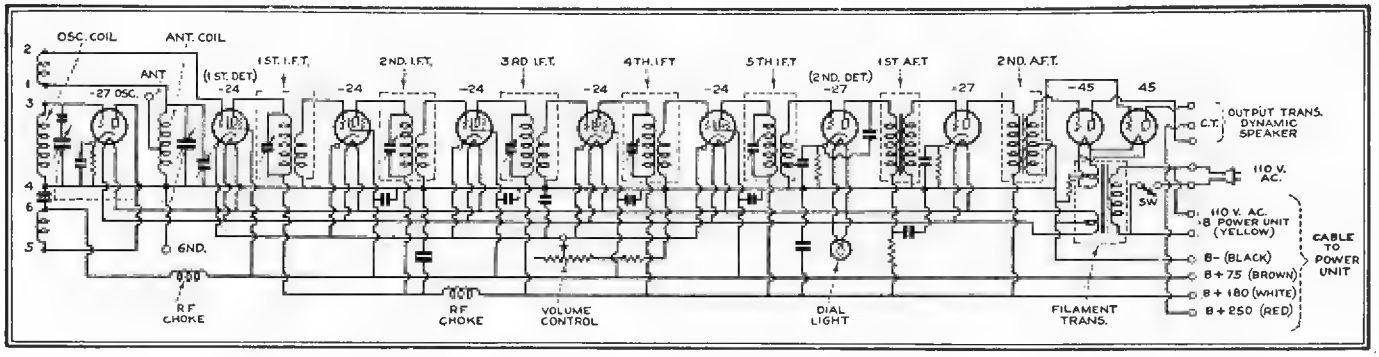
"It is not possible to get all of the gain out of a transformer, when used between three-electrode tubes, because a condition of instability and a

(*Continued on page 93*)



The schematic diagram of the power pack for the Lincoln.

The circuit of the Lincoln Super is shown below.



Foods that Fight Your Stomach

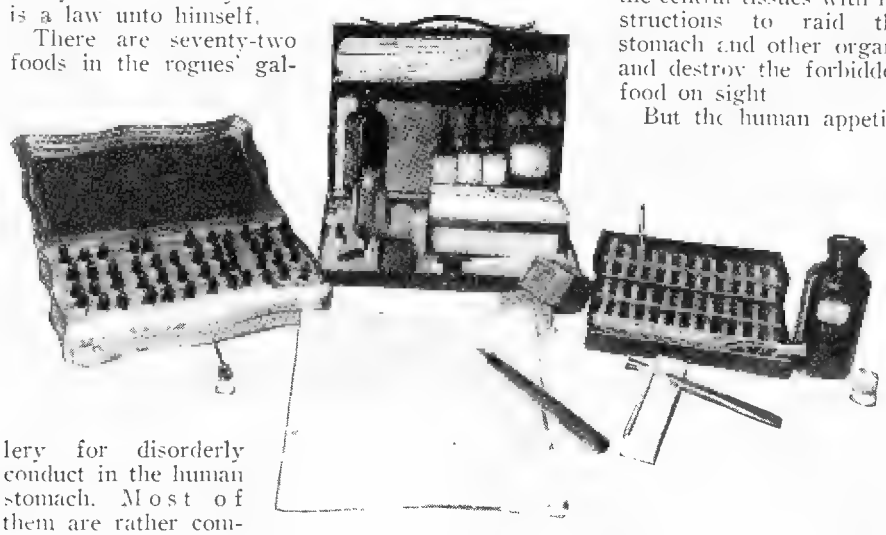
Science Now Makes Your Skin Tell Which Elements of Your Diet Disagree With You

By Frederic Damrau, M.D

IT is a remarkable fact that foods which are ordinarily quite nutritious and entirely harmless may cause sudden illness in the case of susceptible persons. These unfortunates are said to have an *idosyncrasy;* which means that they have a queer habit of becoming sick after eating some particular food that nourishes other people. The old proverb, "one man's food is another's poison," has a scientific foundation.

When it comes to food idiosyncrasies, every man is a law unto himself.

There are seventy-two foods in the rogues' gallery for disorderly conduct in the human stomach. Most of them are rather common articles of diet, such as milk, eggs, beef, cheese and various kinds of beans. They all contain *protein*, which is an organic combination of carbon, nitrogen, hydrogen, oxygen and sulphur. It is the protein element of the food to which persons with an idiosyncrasy are sensitive.



We could not live without these seventy-two foods. If the doctor attempted to eliminate all the foods that *may* cause trouble, there would be nothing substantial left to eat.

Luckily there are scientific tests by which the exact food at fault in a given case may be determined. We must bear in mind that there is no way of deciding by the symptoms whether milk or spinach, or in fact, any one of the seventy-two suspects, is to blame. Food *allergy*, or the condition of sensitiveness to the protein of some particular food, acts pretty much the same whether the illness occurs in a lobster-sensitive man after a cabaret supper or in a cabbage-sensitive fellow after a dinner with his wife.

When one is sensitive to a food, his whole body fights against its introduction into the system. The body passes a prohibition law against this food, which is more rigidly enforced than the Volstead act. Then *antibodies*—the body's prohibition agents—are sent out by the central tissues with instructions to raid the stomach and other organs and destroy the forbidden food on sight

But the human appetite plays the rôle of the bootlegger. And a very successful smuggler it is! The man whose mission in life is to have hundreds of lobsters boiled alive will defend the honor of the Crustacean family to the last claw. And so, if he happens to be sensitive to lobsters, he

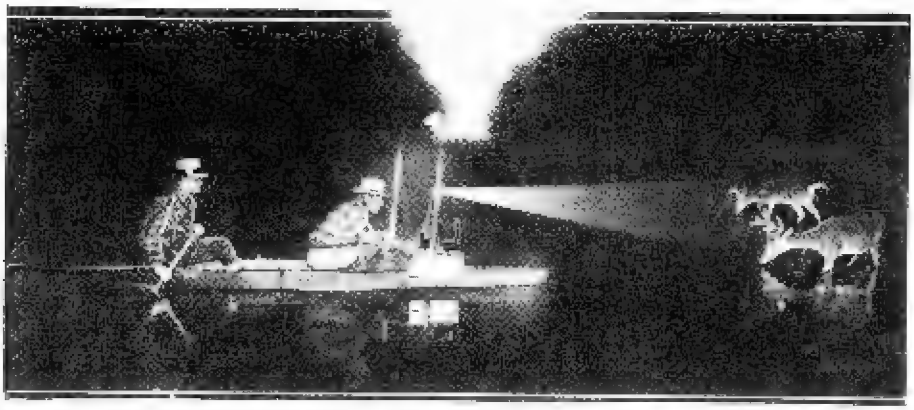
(*Continued on page 73*)

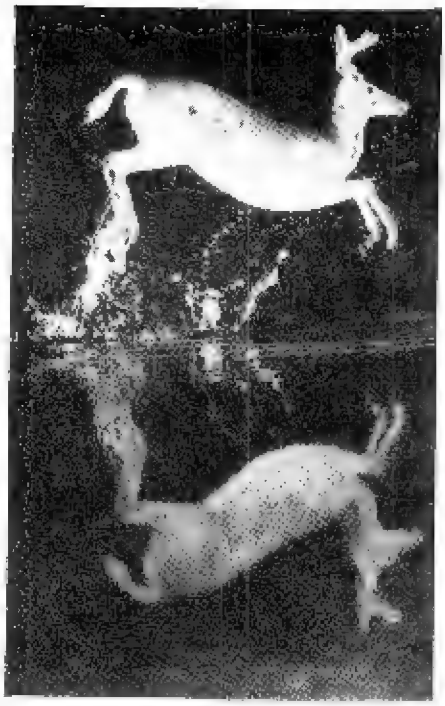
Photo courtesy Arlington Chemical Company.

This person cannot eat eggs until he is desensitized. The upper large reaction was obtained with egg white protein; the reaction next below was obtained with the same in dilution; the next was the negative control—small white dot; and the lowest reaction came from chicken protein.

The diagnostic set used in making cutaneous tests for food allergy, with the fountain pen ready for recording on the diagnostic sheet. Proteins are available in the form of pollen extracts, animal epidermal proteins and others.

Food sensitivity test. The forearm is cleansed with 40% alcohol and scratches about ⅛-inch long and an inch or more apart are made, but only a trace of blood is drawn. The protein is then applied.





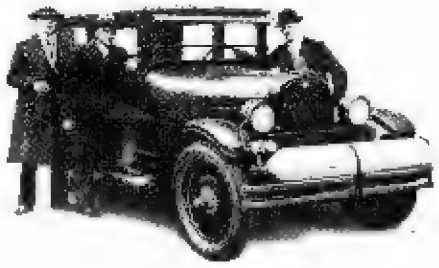
Photographing Wild Life at Night

HOBART V. ROBERTS of the New York State College of Forestry used a novel rig for taking photographs of wild animal life at night. This consisted of a pair of uprights mounted on a canoe and a camera suitably set in the bow. When an ordinary electrical flashlight penetrated the darkness and disclosed the animal feeding or drinking, the flashlight powder was set off and the camera shutter clicked. The first photograph reveals a pair of fawns calmly enjoying a nocturnal drink. They did not get a chance to become startled. A second fawn became terrified at the approach of the canoe and leaped for safety. At that moment the camera was again operated, with the strikingly beautiful result shown at the right.

In the Spotlight *of* Science

Acetylene-Driven Automobile

ACETYLENE was used as a substitute for gasoline in a recent experiment in Pittsburgh, Pa. The tank of acetylene was mounted in the front of the automobile and a tube conveyed the gas to a mixing chamber where water and air were added. This fuel proved to have many advantages, among which are lightness, power, and quick starting in any kind of weather. There is a total absence of deadly carbon monoxide gas. The photograph shows the inventors, Frederick Keitel, G. C. Jones (who first used this form of fuel in 1923), W. C. Duve, and their car.

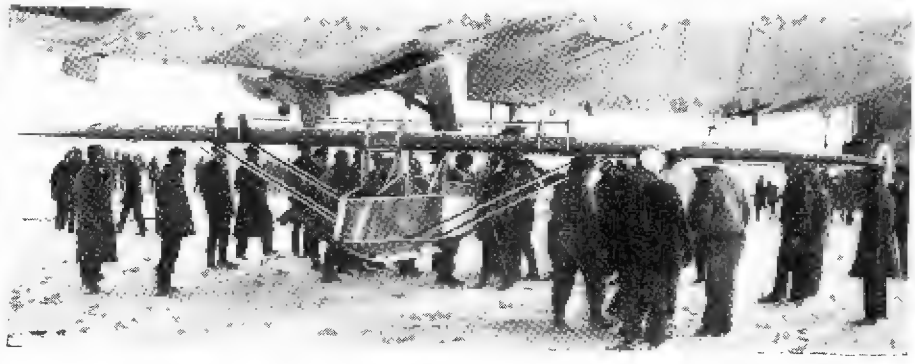


New Plane Flies Like a Bird

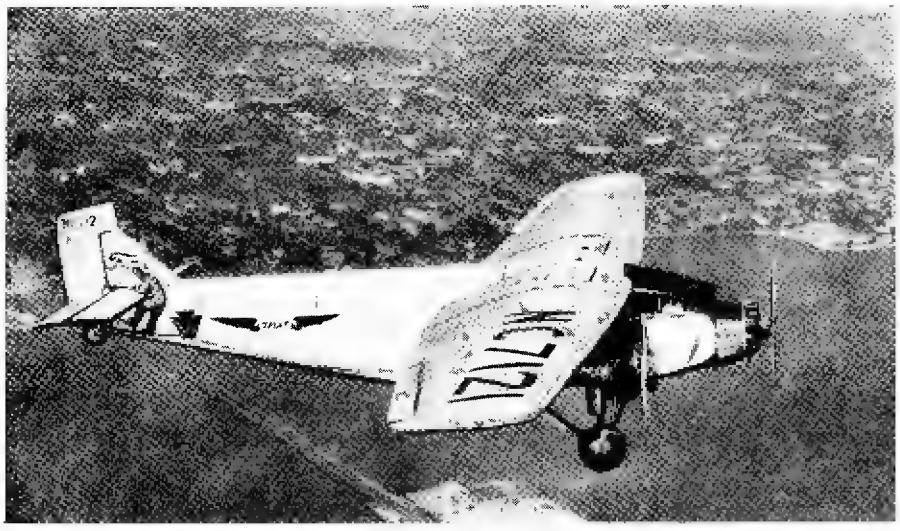
A NEW development of the ornithopter type of machine was recently announced by Captain Sarin, who won the Clifford Harmon trophy for aviation in 1929. The ornithopter is a flapping-wing type of airplane. This one uses no propeller. A successful test caused enthusiasts to predict the new plane would revolutionize power flight.

Glider Launched from Zeppelin

IN order to demonstrate that a glider can be launched from a zeppelin and land exactly where the pilot plans it should, Lieutenant Ralph S. Barnaby dropped from the U. S. Navy dirigible, Los Angeles, when the big airship was at an altitude of 3,000 feet over Lakehurst, N. J., on January 31st. The glider came to a perfect landing on the snow-packed field after flying in wide circles and crossing the terrain a dozen times. The flight took twelve minutes and demonstrated the feasibility of releasing a man from a zeppelin for the purpose of directing ground crews in mooring a dirigible of large size. Because the pilot of the glider can accurately settle down in a relatively small area, the method is far superior to a parachute drop. A special rig was fitted to the Los Angeles to hold the glider until the descent was made.



Tri-Motor Monoplane Is Repaired in Flight

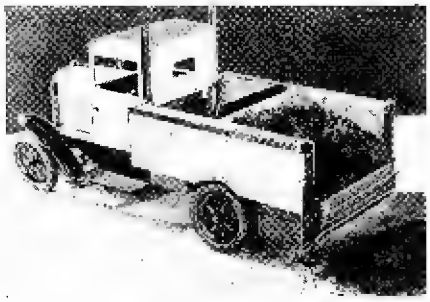


IN an experimental flight over Miami, Florida, James Terry proved that he could repair a rudder cable control in four minutes should it break while the plane was in flight. A cable was stretched between two points along the fuselage for Terry's exploit. This demonstration blazes another trail in safe flying and indicates that it is now possible to remove hazards from passenger flying by making repairs in midair. Captain Goodsell was the pilot in this experimental flight and the plan used was an all-metal tri-motor ship.

Alcohol, Not Frost, Colors Autumn Leaves

ACCORDING to Samuel G. Hibbon, lighting specialist of the Westinghouse Lamp Co., alcohol, *not* frost, is responsible for the autumnal colors in forest foliage. When the leaves reach the turning point in their natural life, their powers of absorption begin to change, and a chemical action takes place in the leaf tissues. The change in chemical composition involves a slight fermentation, and when alcohol appears, the leaves gradually turn red. It is a well-known fact that plants require sunlight, but even in those sections to which the sun does not penetrate it is possible to produce vegetables and flowers if there is an abundance of cheap electric power. Mr. Hibben declared that by excluding natural sunlight from growing plants and substituting various colors of the spectrum, man can exercise a great control over nature. This fact, but not in detail, has been known to farmers who exclude daylight from certain vegetables so as to make the leaves more tender and the vegetables more appetizing. Sunlight is practically excluded from all celery grown for table use.

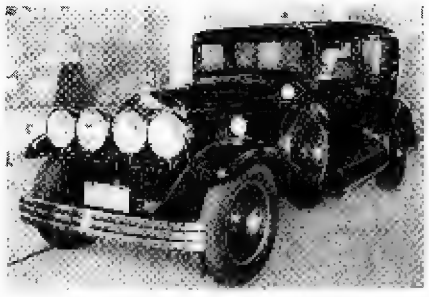
Truck Has Moving Floor



A FLEXIBLE floor, electrically operated, is a salient feature of an English motor truck. The floor moves backward and coils beneath the vehicle as it discharges its load. So far the device has been demonstrated in model form only.

Testing Automobile Headlights

A WILLYS-KNIGHT Great Six has been especially fitted with almost every type of motor-car lighting device for the research and development work now being carried on by the Westinghouse Lamp Co. The lamps will take practically all types of lenses and are equipped with micrometer adjustments for correct focusing.



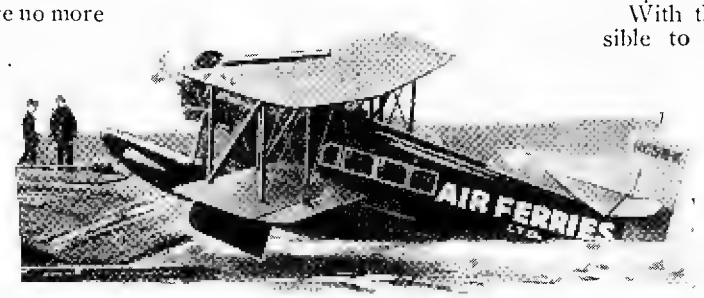
Looping the Loop in a Glider

AFTER being towed to a considerable height, Mr. E. Heath, one of the pioneers in the airplane industry, looped the loop four times before landing his glider. The Heath experiment was conducted at Chicago and this photograph was taken immediately after performing this remarkable feat.

Airplane Ferry Service for 'Frisco

AN air ferry between San Francisco, California, and Oakland, California, operates on a fifteen-minute schedule, with six minutes' flying time. It is believed that this is the first air ferry installed between any two cities in the United States. A whole fleet of Loening amphibians is used in this service and the passengers have no more difficulty embarking on the air ferry than they would on any of the regular ferryboats.

This experiment may be a forerunner of many other air ferries that will be started in different parts of the country. No expensive docks are needed because a simple sloping platform permits the amphibian to pull up out of the water and set its passengers ashore on perfectly dry land. We can look upon this experiment with a keen degree of interest and await its adoption throughout the country.



Half-Tones Are 50 Years Old

ON the 4th of March a luncheon was given by William Gamble and other European authorities on picture printing, in celebration of the anniversary of the invention of half-tones, at which Stephen H. Horgan, the inventor of the process, was the guest of honor. Mr. Horgan, who is a pioneer in various forms of illustrated journalism, first proved in 1897 that the half-tone could be reproduced by the modern newspaper press. The first half-tones that were ever printed appeared in a newspaper called the New York *Daily Graphic*. This was on March 4, 1880.

With the half-tone process it is possible to get the photographic results portrayed on this page. Before that time etchings, woodcuts, and line illustrations were the vogue and, of course, they left much to the imagination. Picturization in those days depended entirely on the skill with which the artist depicted a scene or event.

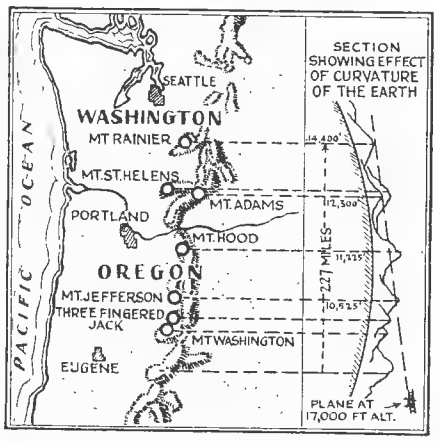
Award Made for Long-Range Aerial Photograph

THE Mackay Trophy for 1929 has been awarded to Captain A. W. Stevens, Army Air Corps, for his outstanding aerial photography, which includes an aerial photograph of Mount Rainier made from a plane 227 miles away. This distance exceeded by more than 50 miles Captain Stevens' own previous record for long range photography. Mount Rainier is in the state of Washington, but the photograph was taken from well south of the center of the state of Oregon. The 227-mile picture shows, quite clearly, mountains far beyond the distance that the human eye can see. Even on clear days the atmosphere contains sufficient haze to limit vision to much less than 227 miles, but the long distance pictures were made possible on film sensitive to the invisible infra-red rays that penetrate haze and smoke.

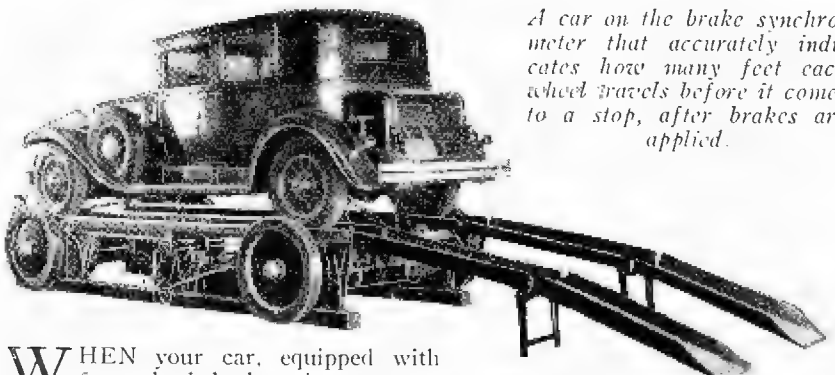
Captain Stevens could not see his objective and was obliged, on the various days when he attempted the picture, simply to point his camera in the direction of Mount Rainier and then await the development of his films to learn whether or not he had been successful. When the negative showed that Mount Rainier had been recorded, the distance was measured, on a map. When the photograph was taken the plane was at an altitude of 17,000 feet.

It is expected that scientists employed by the Eastman, Bausch and Lomb, and Folmer companies will coöperate with Captain Stevens in an attempt to increase the camera's range.

Captain Stevens and one of his 227-mile aerial photographs.

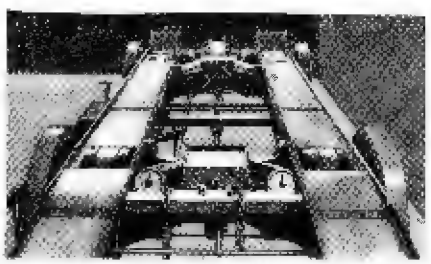


Machine Makes Record of Faulty Brakes



A car on the brake synchrometer that accurately indicates how many feet each wheel travels before it comes to a stop, after brakes are applied.

WHEN your car, equipped with four-wheel brakes, is put to a test, do you ever find that the car has a tendency to swerve to the right or left? If so, you know that the brakes are not properly adjusted. When you attempt to regulate them yourself, you usually make a hit-or-miss job of it, but a brake synchometer will actually tell you which brakes are at fault. This is a mechanical device that permits you to duplicate the energy of a vehicle moving at a selected speed and then to dissipate this energy by the application of the vehicle's brakes. At the same time you automatically record the results of the braking effort afforded by each wheel. The testing power is supplied by the vehicle itself. The synchrometer consists of two axles, on each of which are mounted



two flywheels. The axles are connected by a shaft and worm gears. The vehicle to be tested is brought up to the required speed by its own motive power, the energy being transmitted to the drums which rotate the flywheels. The brakes are then applied and a dial records the exact number of feet traveled by each wheel, from the time the brake is applied to the time the wheels come to a stop. Adjustment is thus made accurate and easy.

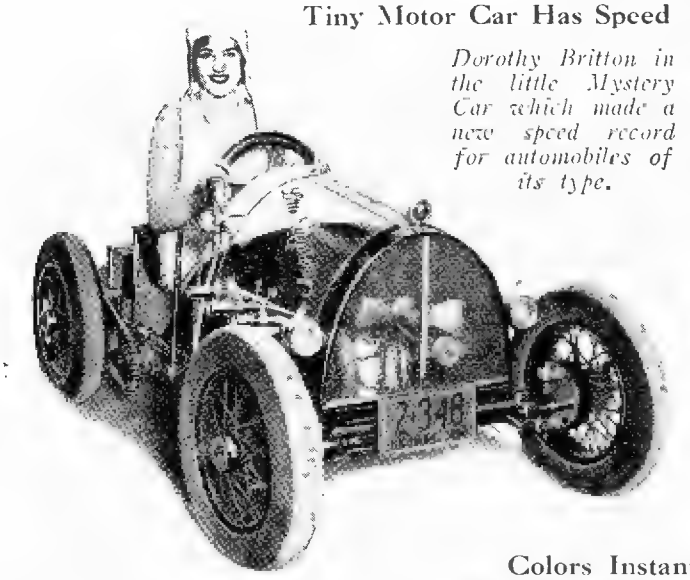
Thawing the Earth for Gold

ALASKA'S latest gold strike is in the vicinity of Poorman. The Poorman placer vein was discovered by Mike Kovas, Tom Gallagher and James August, and is in the west central part of the territory. The latest man to stake a claim was Sergeant William M. Growden of the Signal Corps Unit at Ruby, Alaska, who took five days' furlough so that he and his companion, Chief Harry Pitka of the Kokrine Indians, could pan for dust. The temperature at Poorman being at 40° below zero, it was necessary to break off pieces of frozen earth, hold them in a pan containing water, and then boil the water to thaw the earth out. In two pans $2.96 worth of gold was obtained.

A Spider-Line Fire Escape

A PORTABLE apparatus by means of which occupants of upper floors can escape in case of fire was recently demonstrated in London, England. The photo shows Miss Paddy Naismith testing the apparatus at the new Y. M. C. A. building at Hornsey. The speed of descent is regulated by the device containing the reel of wire

Tiny Motor Car Has Speed



Dorothy Britton in the little Mystery Car which made a new speed record for automobiles of its type.

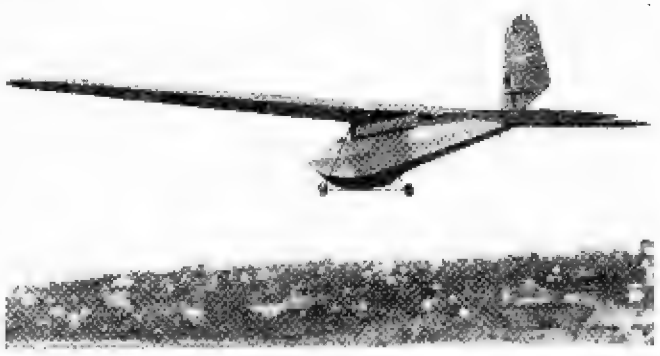
IMAGINE a car only 24 inches high, with a 52-inch wheelbase, that cost $9,000 to build! It was designed by K. L. Morehouse and was on exhibition at the automobile show in Chicago, where it attracted much attention not only for its unique size and design but also because of its remarkable speed. In a test it attained a speed of 91.2 miles per hour.

Find New Depth in Carlsbad, New Mexico, Cave

FRANK EARNEST NICHOLSON, of New York, the leader of the Carlsbad cavern expedition, has discovered a new low level about 1,350 feet below the surface. This new depth is 325 feet lower than what was formerly considered the deepest level of the Carlsbad caverns. The heat here was stifling and there seemed hardly enough air to permit breathing. Marvelous formations known as cave pearls were found and a nest of white crickets was discovered.

Eliminating Blanketing Effect from Transmitters

STATION KDKA of the Westinghouse Electric and Manufacturing Company has erected a new antenna near Saxonburg, Pa., which will not send a "blanketing" signal over the surrounding territory, but will reach distant points. This will enable receiving sets near the station to tune in on distant programs. The antenna is formed by a huge circle of wooden poles 800 feet in diameter and 110 feet in height bearing a bird-cage aerial.



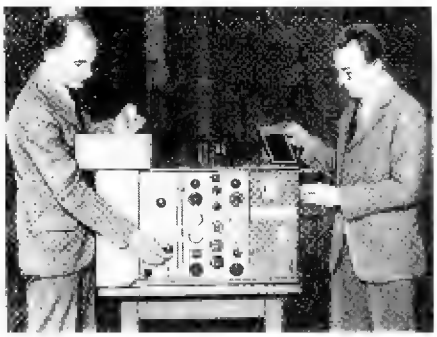
The Bowlus glider which established a new American flight record.

Soaring Glider Sets New American Record

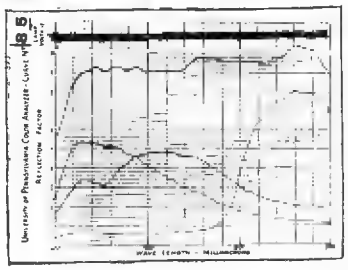
W. HAWLEY BOWLUS, an expert at handling and building gliders, recently established for the second time in seven days a new American record for duration of flight in a motorless plane. He remained in the air for two hours, 47 minutes and 13½ seconds, and thereby surpassed his own former record of an hour and twenty minutes.

The design of the Bowlus record glider makes it particularly suitable for sustained soaring flights, and the mountainous country in the vicinity of Los Angeles, California, is admirably suited for the establishment of new flight records. This is the same glider which Colonel Charles A. Lindbergh flew so successfully and regarding which he stated that flying a glider is comparable with setting sail in a yacht. One need not worry about the motor, nor does one hear the constant throb of the engine or feel its vibration.

Colors Instantly Analyzed



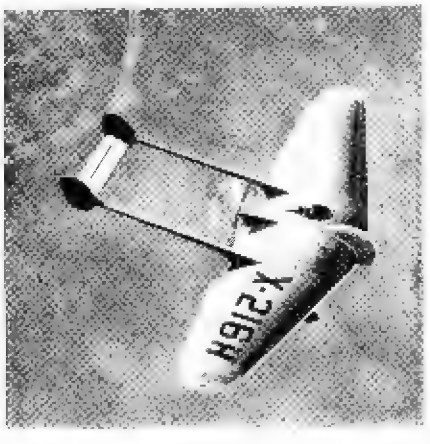
In the University of Pennsylvania's Department of Physics, Joseph Razek and Peter J. Mulder developed this machine which analyzes colors almost instantly. At right is a graph of a color analysis.



AN automatic apparatus with which the colors of transparent and opaque objects can be analyzed with scientific accuracy in less than 10 seconds has been developed in the graduate laboratories of the University of Pennsylvania's Department of Physics, under the direction of Dr. Charles B. Bazzoni, professor of experimental physics. The method was perfected by Joseph Razek and Peter J. Mulder, instructors in the department. The sample to be tested is placed over a small rectangular opening at the top of a box, about the size of a large suitcase, where the sample is illuminated by a powerful source of light. Light is reflected from the sample to a spectroscope which separates it into its component colors and then passes into a photo-electric cell. The current is amplified, then indicates on a sensitive galvanometer and records on a photographic film. By turning a crank, the operator admits different portions of the spectrum to the photo-electric cell, until the entire spectrum has been completed. The machine is expected to find wide application.

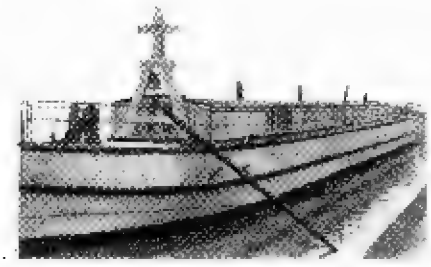
An All-Metal Flying Wing

POWERED with a sixty-horsepower engine, and experimental all-metal monoplane, involving radical changes in aero-dynamic features and combining wing and fuselage, has been flown faster than 100 miles an hour. The plane was developed by the Northrop Aircraft Corporation, a division of the United Aircraft and Transport Corporation.



Floating Church

SEAFARING men have for 25 years sought comfort and religious guidance in a unique ship which is the only floating church in the world. This church recently celebrated its 25th anniversary and is here shown tied up in port in Berlin, Germany. It has a congregation made up largely of fishermen and was first opened on January 12th, twenty-five years ago.



Growing Plants Without Sun or Soil, Under Colored Lights

AN experimenter of the Smithsonian Institution, Frederick S. Brackett, in charge of the division of radiation, has been growing plants without sun or soil to discover the effect of radiation obtained with various colors of light. The plants are placed in an artificial growth chamber where a certain temperature is maintained and they are illuminated by banks of lamps above. Different colors of light are provided, but otherwise the conditions in various test chambers are identical. Not only are the effects of visible light upon plant growth being studied, but also the rays of infra-red and ultra-violet are under investigation in so far as they affect plant growth. The results of the experiments are being eagerly awaited.

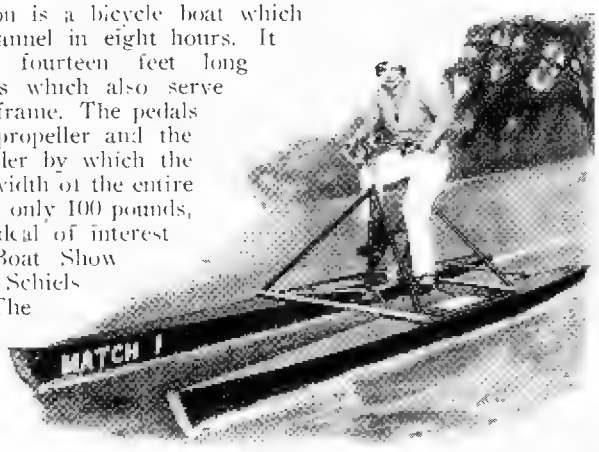
Radio Station at Top of World Faces Isolation

THE United States Army's radio station at Point Barrow, Alaska, the most northerly in the world, is faced with an "all-ice" year, according to Staff Sergeant Stanley H. Morgan of the Signal Corps, in charge of that station. His report to the War Department indicates that there may be a serious food and fuel shortage. The old-timers at Point Barrow stated that unless there was a change of wind and ice conditions within the next two months, it would be impossible for ships to break through with annual supplies.

In normal years the winds here are enough to keep large packs in motion and the northeasterly current carries the packs north in the spring. Sergeant Morgan reports "All indications point to a similar period a number of years ago when no boats reached Point Barrow, forcing discharge of all supplies at Wainwright, with essentials freighted by dog teams during winter."

Sea Bike Crosses Channel in Eight Hours

EUROPE'S latest sensation is a bicycle boat which crossed the English Channel in eight hours. It consists of two pontoons fourteen feet long connected by suitable braces which also serve to support a kind of bicycle frame. The pedals are geared to a shaft and propeller and the handle bars control the rudder by which the contraption is steered. The width of the entire boat is 3½ feet and it weighs only 100 pounds. This boat attracted a great deal of interest at the New York Motor Boat Show where Miss Marguerite Schiels demonstrated its operation. The boat is adapted for use on rivers, lakes and streams. It draws but little water and is capable of being driven forward by foot power at a fair rate of speed. Its ruggedness was proved when it successfully crossed the English Channel.



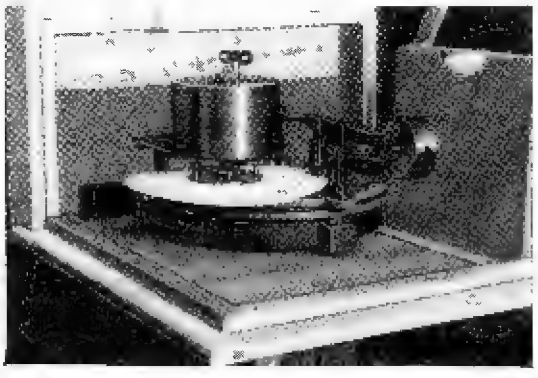
Hardening Copper—A Lost Art?

MOST people mistakingly imagine that the art of hardening copper has been lost. Such is not the case. Copper today is much harder and stronger than the copper of the ancients. W. H. Bassett, lecturer in the School of Mines in Columbia University, says that research workers who seek the magic process by which ancient metallurgists hardened copper are simply wasting time. When copper is heat-treated by a method of treatment which ancients could not apply by their crude methods, it has a tensile strength of 108,000 pounds per square inch and a high elastic limit resembling that of medium carbon steel. By alloying it with various metals Professor Bassett claims that the tensile strength can be raised. When alloyed with silicon it can be welded with as much ease and certainty as steel, but such an alloy produces a wire of high electrical resistance and is, therefore, not used in electrical circuits.

The progress made by science in metal alloys for special purposes is practically revolutionizing the industrial world.

Science Measures Dust in City Air

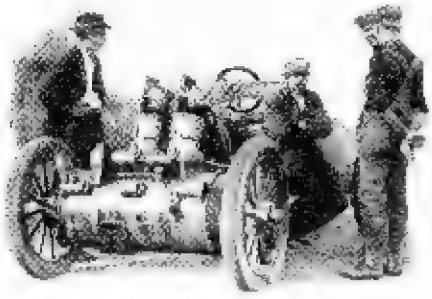
DUST calculations are taken hourly in practically every large city. Efforts are being made to keep cities clean. In New York, David Morris makes an hourly observation in a little-known weather observatory stationed in a sequestered section of Central Park, New York City. For this purpose several mechanisms are employed, one of which is being held in Mr. Morris' hand while he sucks in the air against a microscopic slide and then proceeds directly to count the dust particles. Records are made of these compilations. An average, as struck by the scientist, revealed that there were 38,508 dust particles for each cubic foot of air in the city of New York during the year 1929. Another device, an automatic air filter, automatically records the impurities in the air at all hours of the day.



Measuring city dust.

An Early Front-Wheel Drive

IT is not generally known that an automobile with a front-wheel drive ran in the Vanderbilt Cup races in 1908, but such was the case. Here is a rare photograph of the car quite well stripped so as to show the mechanism. By even a casual examination one will see that it differs vastly from front-wheel drives as they are



now known, but then there is a vast difference in most features between the automobile of 1908 and the automobile of 1930. This car, the Chrystie, possessed but two cylinders.

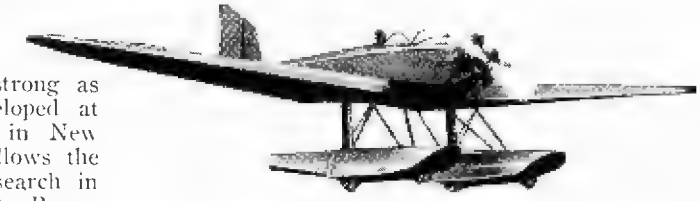
When Short Waves Fail, Blame the Sun

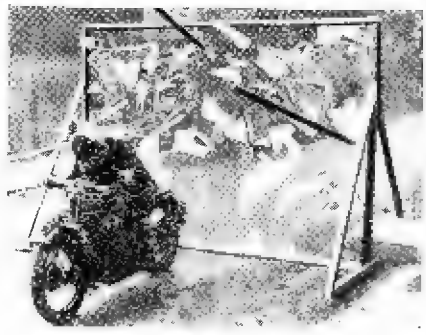
IN the experiments in trans-Atlantic broadcast, both engineers and radio listeners were disappointed when the programs did not come across as announced. When asked as to the reason, C. W. Horn, the general engineer of the National Broadcasting Company, blamed magnetic disturbances due to unusual sunspot activity. He explained that the extreme rapidity with which such disturbances become acute makes it impossible to foretell conditions and live up to the rebroadcast schedule.

If sunspot activity is the cause, we can hope for an improvement in conditions for the next five or six years, after which they again become worse. The sunspot cycle is about eleven years.

A Strange Plane

A NEW amphibian of the Aero Marine Corporation has two wheels set one behind the other in each pontoon. Its flight amazed experienced pilots, who had expected to see the plane crash when making a landing.



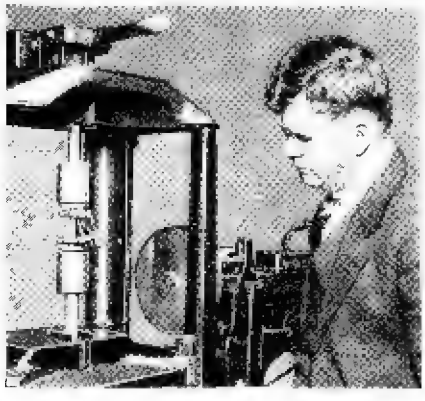


Motorcycling Through Plate Glass

A DARING British cyclist, Harry Lorrain, demonstrated before crowds his ability to dive right through a plate glass window without even being scratched. The plate glass was set in a frame directly in the path of the speeding cyclist. His hands were covered with leather gloves and a large hat protected his head and ears from the flying pieces of glass. At a speed of approximately 50 miles an hour the motorcycle ran right through the plate glass without in the least injuring the driver. Bystanders were thrilled at the performance, which was given in London, England. No one seems to have recorded the reactions of the cyclist as he heard the glass crashing about him at the instant the impact occurred.

Gold Stronger Than Steel

ACCORDING to Professor R. C. Brumfield, gold alloys three times as strong as bridge steel have been developed at the Cooper Union Institute in New York. The announcement follows the results of three years of research in the field of dental gold, and Dr. Brumfield has developed nearly 60 new gold alloys. It is a known fact that the alloys used in the filling of teeth have to be extremely hard when they solidify. The constant wear and tear destroys present day alloys so there is always a need for the superior types. Dr. Brumfield is shown testing the tensile strength of one of his alloys.



Radium Treats Eye Defects

DR. WILLIAM H. WILMER, head of the Wilmer Eye Institute of Johns Hopkins Hospital now uses radium in small quantities to treat obscure vision blurred through the formation of scar tissue in the cornea. Such treatment hastens the absorption of scar tissue.

Rubber Bumpers for Autos

DRIVING an ordinary stock touring car head-on into poles, pillars, and stationary or moving automobiles, at speeds of from 10 to 30 miles an hour, Captain Franzcarl Schleiff, a one-armed former ace of the German air forces, demonstrated his new crash-absorber to newspaper men, scientists, engineers, safety experts, policemen and insurance officials. In general appearance the crash absorber resembles a usual metal automobile bumper. It consists of a three-inch bar of solid rubber attached horizontally to the chassis by two pairs of claws suggestive of forwardly pointed partly opened scissors. When a crash occurs much of the impact is absorbed before it reaches the chassis.

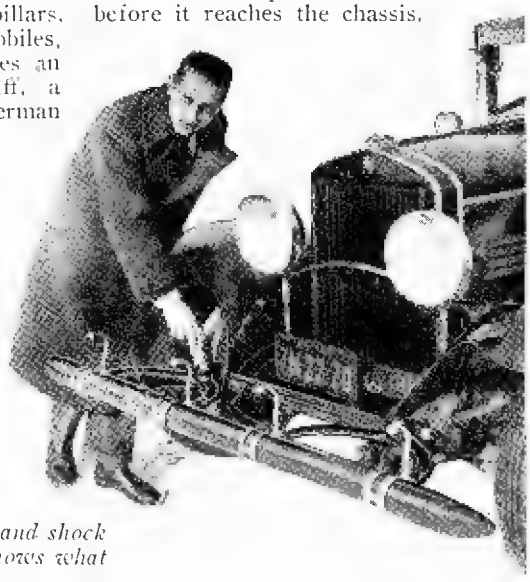
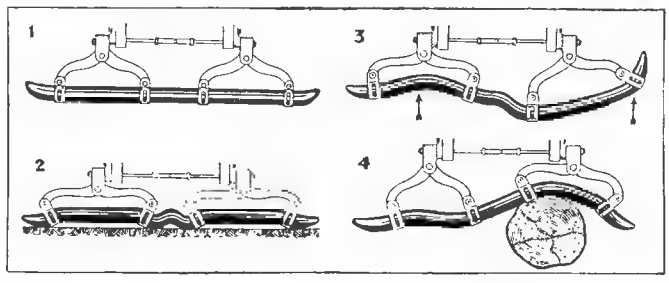
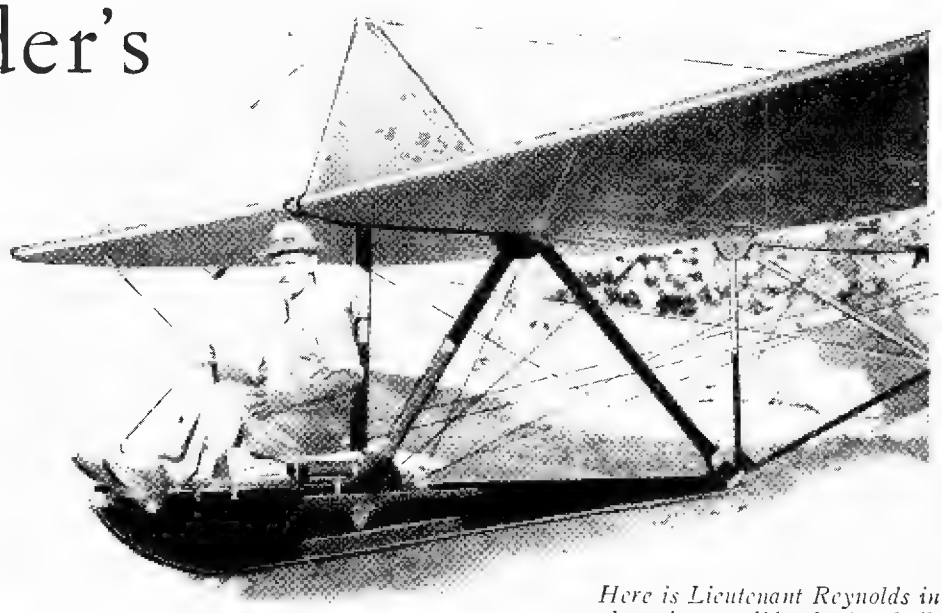


Fig. 1 illustrates a rubber bumper and shock absorber, and 2 diagramatically shows what happens when a flat surface is hit. Note the way the tongs separate and the rubber stretches. Figs. 3 and 4 show what occurs when irregular bodies are met. Much of the impact is spent in the absorber.



Your Glider's Flying Clothes



Here is Lieutenant Reynolds in the primary glider he has built according to the SCIENCE AND INVENTION *plans.*

The first article in this series (published in February) described the construction of wing framework and ailerons. The second (March) took up the elevator, stabilizer, rudder, and the main skid section. Controls and launching hook were considered in the third (April). In the present article the wings are covered and the ship is made ready for the air.

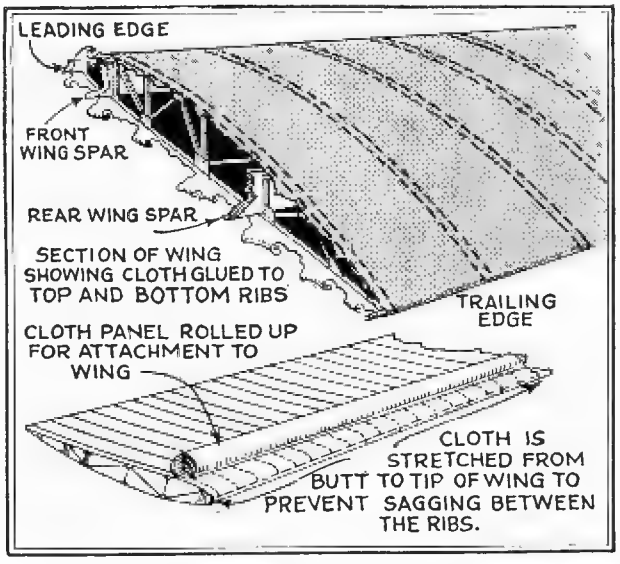
By
Lieut. H. A. Reynolds

IN the preceding articles we have described the construction of the glider framework and are now ready to cover the wings and controlling sections with cloth. There are many varieties of cloth that can be used for this purpose. A good grade of unbleached muslin or No. 100 cambric serves this purpose very well. The Heath Airplane Company, 1721 Sedgwick St., Chicago, Ill., sells a special close weave cotton fabric for 30 cents a yard that is designed for motor plane wing covering and has been found suitable for glider wings.

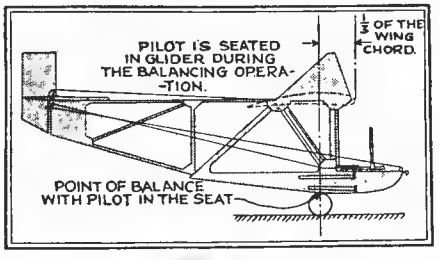
The covering of a wing with cloth has always presented one of the most difficult problems to the home builder. This difficulty, in the opinion of the writer, is mostly mental, caused by the fact that most mechanically inclined men seldom have had experience in cutting and fastening cloth. After the first bit of cloth is fastened into place the fact becomes very evident that no tailoring or sewing ability is needed to produce a smooth good-looking job.

Some builders make up a huge bag of cloth which they slip over the wing tip and pull along towards the butt end, thus covering both surfaces as they go along. This method requires quite a bit of sewing and critical measuring in constructing the bag so that it will fit the wing.

The writer employed the panel method which is very simple and requires little sewing. With this method the builder has complete control of the cloth at all times during the covering job. The only sewing required can be done on the household sewing machine before the cloth is placed on the wing.


LEADING EDGE
FRONT WING SPAR
REAR WING SPAR
SECTION OF WING SHOWING CLOTH GLUED TO TOP AND BOTTOM RIBS
TRAILING EDGE
CLOTH PANEL ROLLED UP FOR ATTACHMENT TO WING
CLOTH IS STRETCHED FROM BUTT TO TIP OF WING TO PREVENT SAGGING BETWEEN THE RIBS.

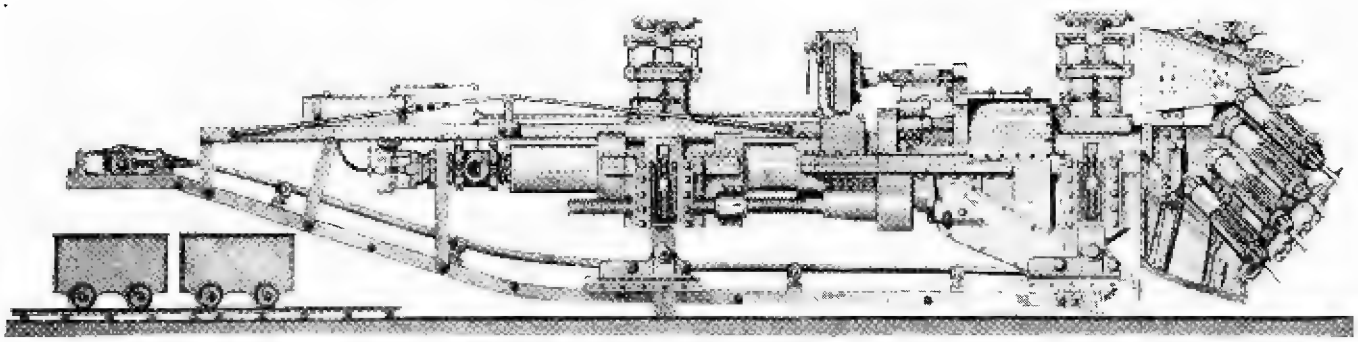
Covering a wing is easy when you follow directions. How the glider is balanced is shown below.



Martin H. Schempp, instructor, demonstrated the Reynolds glider at the Syracuse club's gliding field.

Sew your yard wide strips side by side so that you will have a large panel of a width that will reach from the leading edge around the width of the wing over the trailing edge and back to the leading edge with about two inches to spare. The length of this panel should consist of enough of these strips sewed side by side to extend from the butt end to the tip end of the wing. In sewing up this panel have all the seam ends or edges of the strips on one side. When the cloth is laid on the wing with all of these seam ends on the inside a smooth outside surface is presented for the dope treatment later. Use No. 40 thread and sew each seam at least twice. Two of these panels of cloth should be prepared at this time.

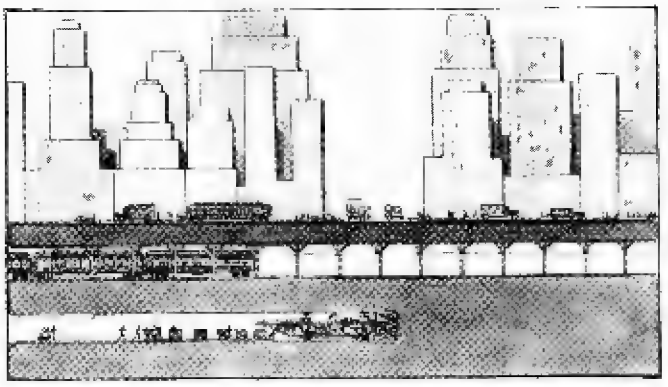
The wing framework to be covered is set up on two saw horses with its bottom surface up. Provide a large quantity of casine glue with an easy flowing brush. You will also need a large quantity of push pins. The panel to be used is rolled up so that the roll will extend from the butt rib to the wing tip with the sewed seam edges protruding towards the inside of the wing. Spread a liberal quantity of glue all along the leading edge and fasten the long edge of your cloth panel to this, holding it in place with thumb tacks. The cloth should be stretched tightly from end to end along the leading edge to prevent it from being pulled down between the ribs when the dope is applied later. Next spread glue along each rib for about one-third of the distance to its trailing edge and fasten the cloth with push pins to the two ribs at the (*Continued on page* 75)



The revolving head chips its way through rock and soil by means of pneumatic hammers and chisels. The resistance met by any or all of the chisels automatically regulates the revolutions and forward speed of this head, which is mounted on a main shaft extending the length of the horizontal carriage. The cutting head is forced forward by a feed screw. A stationary vertical supporting carriage is rigidly braced against the interior of the tunnel and forms the abutment for the thrust of the head.

How Giant "Moles" Bore Under Streets

By Josef W. Von Stein



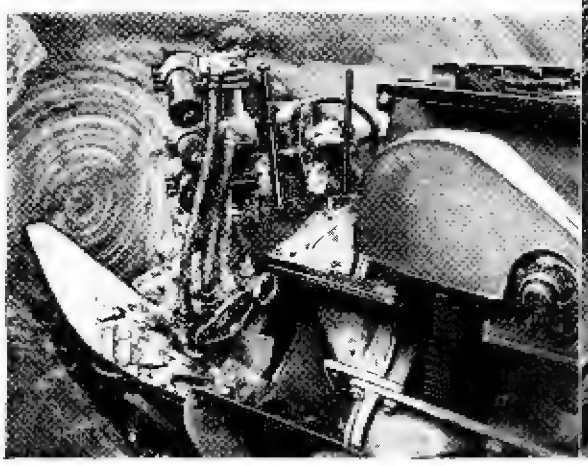
Tunnels may be bored under all existing structures without any external disturbance or interference.

A VIVID picture arose in my mind as Mr. Oliver O. App, mining and mechanical engineer, explained the intricacies of the automatic tunneling machines which he has evolved after years of experimentation.

Experience has shown that the efficient method of working through rock is cutting by chisel and hammer. The powerful pneumatic hammers used in this machine compare with the hand hammer and chisel as the modern steam shovel compares with the hand shovel. Tunneling and excavating is accomplished without the danger generally attendant upon the use of explosives. Rock is chipped away by the action of eighteen or more powerful pneumatic hammers and chisels assembled on the head, which head turns on a longitudinal axis. The hammers and chisels are so arranged that they cut in concentric circles. With an air pressure of 80 to 100 pounds per sq. in., the hammers strike a tremendous blow, each hammer being capable of delivering 500 or more strokes a minute with a force approximately from 1 to 50 tons to each impact. The entire operation of the machine is automatic, cutting and loading simultaneously.

As Mr. App says: "The secret of the greater measure of success of this machine is contained in the fact that there is a distinct relation between the character of cutting and the action of the hammers. The point of control is where the chisel touches the rock. When there is no contact, the hammer does not act, but the instant resistance is encountered the individual hammer begins its work. The amount of resistance automatically regulates the force and speed of the hammer action—the harder the rock the more powerful and the more rapidly the blows are delivered, each hammer acting independently. As the revolving head advances, all the hammers may be working at once or one only may be in action for a time. The speed of (*Continued on page 80*)

The head carries a number of pneumatic chisels, so arranged that the chisels cut in concentric circles, producing a vertical, circular face.



Center, the head of a machine in a tunnel in New York subway. Below, aqueduct tunnel cut through a mountain in Pennsylvania.

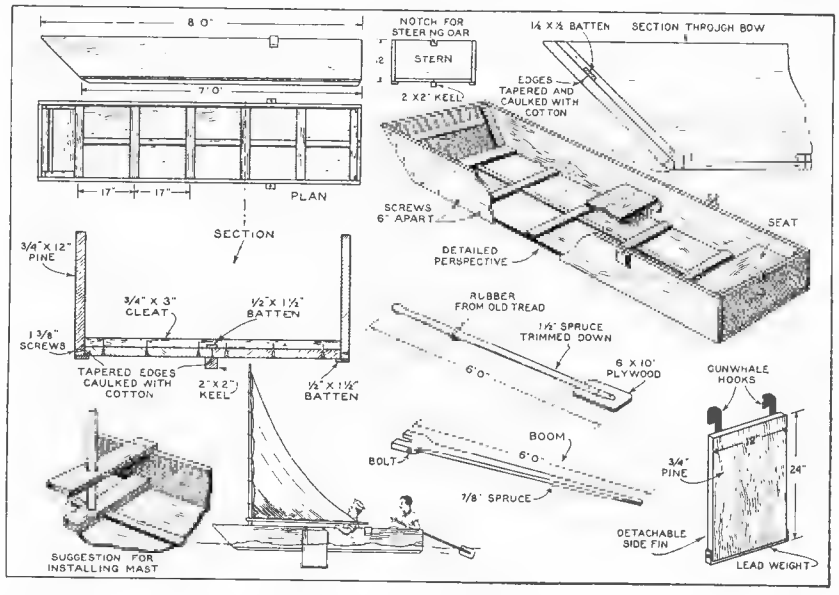
Build a Boat for $3.62

Here's Your Chance to Get a Sailboat for Less Than a Five-Dollar Bill

By Hi Sibley

Six passengers and almost room for one more.

ONE of the boys of the neighborhood was going to the beach within two days. He had three dollars for spending money, but no boat. And he told the world that he *wanted* a boat. So we organized and planned, and within twenty-four hours from the time we set out for the lumberyard after material, his boat was successfully launched in the neighborhood pool. The cost exceeded his finances by only 62 cents.



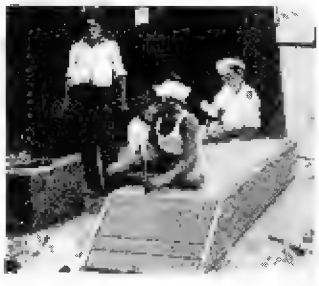
Here are the complete plans for the construction of this inexpensive and easily made boat. It will provide much pleasure when the spring winds fill its tiny sail. A list of materials will be found in the article.

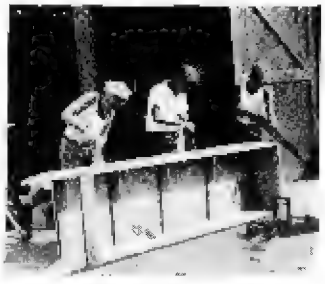
Here's the way we went about it. A rough sketch was laid out like the accompanying drawings, boards were purchased and brought home in the car, each piece marked and one boy set to sawing to size. As fast as they were cut another boy was assigned to drilling screwholes, and two more assembled the bottom.

All the edges, as indicated, had first been beveled with a plane to make v-shaped cracks into which the cotton was caulked. The bottom was made of two finished pine boards 7 ft. long, ¾ in. thick and 12 in. wide (finished size for the latter is 11½ in., but the drawings are made on a 12 in. basis). These bottom boards were fastened together by means of six cross cleats 24 in. by 3 in., set approximately 1 ft. 5 in. apart on centers. No. 5 flathead woodscrews, 1⅜ in. long, were used. Next the side boards were put on, using the same size screws as in the cleats. Temporary thwarts or crosspieces were nailed to the top edges to hold them in place while assembling.

Next came the transom, or stern board and then the sloping bow pieces. The most difficult job of all was fitting the joint between the bow board and the front end of the bottom. It must fit snugly, with the usual v-crack for caulking. It is covered by a cross-cleat on the top side, which has been planed to a bevel to allow for the angle at this point. In each of the four corners was screwed a ¾ in. by 2 in. piece to reinforce these points. Between the cross-cleats ½ in. by 1½ in. battens were screwed over the crack in the center of the bottom.

Caulking is easy, but takes considerable time for a proper job. However, with four boys at work it was accomplished in less than two hours. Cotton was rolled into strips and driven into the cracks by means of tapping a screwdriver with a block of wood. The cotton was necessarily forced well below the surface of the boards.





One hand sawed, another drilled screwholes, while a third put in the screws, and four boys caulking finished the job in less than two hours.

By four o'clock in the afternoon we were ready for painting. A light green appealed to the skipper, and light green it was. This, ordinary house paint, was sloshed generously into the cracks over the caulking, after which outside and inside were covered all over, and the boat left to dry over night.

Next morning the crew was on hand early to complete the job, screwing on the 2 × 2 in. keel and bottom skids, or battens (which had been painted the day before). And then the triumphant launching. Of course the water seeped in here and there through a crack at first, but in a short time the wood had swelled and the hastily made craft became water-tight, as it has been ever since.

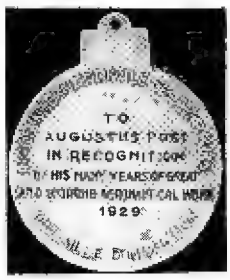
While no seats nor sails were made at first, it is the skipper's intention to add this equipment, as per the drawings. The mast was planed round and tapering, from an 8 ft. length of 2 by 2 in. spruce, and set in sockets as shown.

In place of a centerboard and the center well, (*Continued on page* 81)

The way I see it—

By Murray Godwin

Medaille d'Honneur

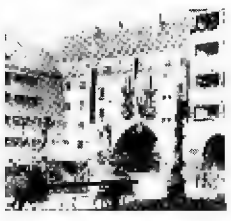


AUGUSTUS POST has been awarded the Medal of Honor of the International League of Aviators, that brotherhood of the air which in its four years of life has grown to embrace the aeronauts of nearly forty nations. . . . Each year the League bestows tokens of its high esteem on those who have distinguished themselves by outstanding accomplishment in the aeronautic field. Juan de la Cierva, Sir Alan Cobham, Colonel Lindbergh, and Baron Huenefeld are among those previously honored. . . . Mr. Post has been recognized by the League, not for any single achievement, but for a long and rare record of devotion to the advance of aviation. Not that he has no outstanding feats to his credit. With the founder of the League, Clifford B. Harmon, he went aloft years ago in a free balloon, and together they set a record which has never been surpassed. But it is for his patient, active service in behalf of aviation in its every phase that the League has chosen to award him its Medal of Honor, and in congratulating Mr. Post we make bold to say that, in our judgment, on no one could the distinction more fitly have been bestowed.

The Lifting Power of Rents

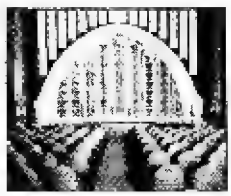
RETAIL merchants who once occupied shops on Manhattan's principal thoroughfares have in many cases found themselves forced into side streets by the pressure of increasing rents. The new Fuller Building is designed to offer the retailer a chance to keep his front on a main avenue of commerce at the cost of a partial vertical move, instead of a complete horizontal one which may take him around the corner into an undistinguished street. . . . Fronting on 57th Street at Madison Avenue, the Fuller Building has its six lower floors divided vertically into seven independent units, each six stories high. Each has its own entrance and an elevator joining its six vertical parts, all of which front on 57th Street. The merchant whose mounting rental forbids his lease of a ground-floor expanse for his whole establishment, now can place five-sixths of it in vertical order above the ground-floor unit, and see the rental per floor go down as the shop expands upwards.

Sterilizing Crime Cultures



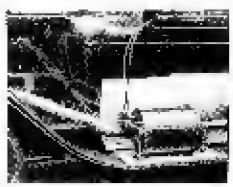
WHILE more prosperous cities exert themselves to combat crime with (figuratively speaking) serums, sanitariums, and surgery, Vienna in its proverty is striving to eliminate it by hygienic measures at its source. In the filth and gloom of the traditional slums, Vienna thinks, the germs of future felonies find their most favorable breeding ground. Sterilize the breeding ground today, and you will prevent contagion tomorrow. So Vienna, acting on this theory, has applied its housing taxes collected from 1925 to 1928 to the elimination of old tenements and their environs, and to replacing them with communal houses of the cleanest, brightest, most modern type, surrounded by park spaces where sunshine can be had in plenty and where flowers can grow. . . . Now six thousand families of the lower economic stratum are housed in Vienna's communal dwellings, and the work of replacement still goes on. . . . Perhaps defeat, after all, is not the worst thing that can happen to a nation. Denmark, when its chances for conquest were cut off by the growth of other European states, developed an agricultural coöperation which has placed Danish dairy products in an enviously high position throughout the world, and an educational system which seems destined to make its people the most cultured of any. And now Vienna, center of an impoverished territory, is applying itself to improvement with a vigor which under other conditions might have been directed to intrigue and preparation for war.

High Art Moderne



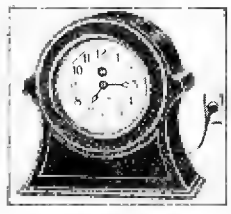
RENTS have been lifting retail establishments into vertical form. It is said that the urge for exclusiveness in thick-settled Manhattan is the force which has elevated the Chanin auditorium to its position on the fiftieth floor of the building called by that name. . . . In any case, the auditorium is a fine example of the playhouse furnished and decorated in art moderne. There are checkered chairs for 200 people. The stage curtain is of extremely modern conception. A rainbow lighting effect is given the proscenium arch, and filagree panels over the stage are illuminated in a variety of colors, when the theater is in use. On the sidewalls are fountain designs in silver against a background of bakelite. Black and silver predominate throughout.

Just an Atom of Oxygen

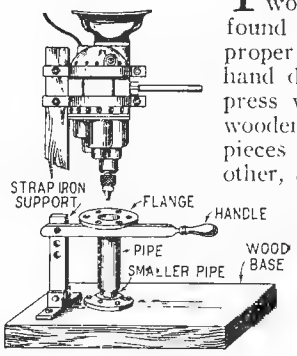


BY ADDING an atom of oxygen to each atom of motor exhaust gas, Professor J. C. W. Frazer of Johns Hopkins intends removing from automobile drivers everywhere the danger of sudden death by carbon-monoxide poisoning. The transformation is to be effected by an exhaust attachment, in which a catalytic agent will act upon the gas before it is discharged into the atmosphere. . . .Back in the early 1900's, American motorists had a slow, puzzled awakening to the dangers of carbon monoxide in a closed garage. One owner wrote in high dudgeon to an automotive magazine, complaining that the maker of his car should be prosecuted for selling a motor the exhaust gas from which rendered people ill. Another followed up with a supporting statement in which he declared he had tried the effects of the vapor on *two* occasions, and both times had been rendered unconscious! And since that time the lack of the vital "atom of oxygen" has too often resulted in death.

Time, Space, and Relativity

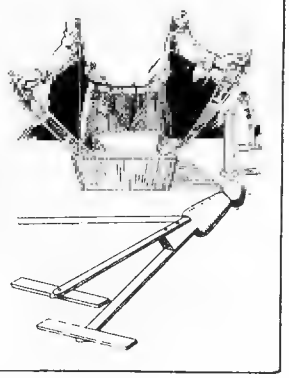


AS CONTROVERSY over the truth of the Einstein Theory has gone on, many of us have come to realize that we have never really believed in the factual existence of time at all. . . . We remember, for instance, hours of excited leisure which have lasted not more than fourteen minutes at the most, and minutes of suspense which have endured for at least a day and a half. For time at best is only a measuring stick with which we try to keep in order the endless succession of events and sensations, and one may achieve an age of 150 in terms of things experienced, and still be on this side of the forty mark. Sixty or seventy years loom up large on the tax records, but it is age in terms of phenomena seen, felt, and participated in which represents the only truth that counts.



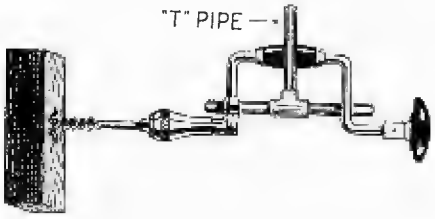
THERE are many young home workshop enthusiasts who have found difficulty in obtaining a proper drill press for their electric hand drill. Here is a simple drill press which may be made with a wooden base, two pipe flanges, two pieces of pipe, one to fit over the other, and one flange for each piece. A few pieces of strap iron complete the press. To operate simply hold work to be drilled on the flange, which serves as work rest, then raise handle.—*William Sharpeinkel.*

WHILE this little kink cannot strictly be called a hint for the home workshop, it may find use around that part of the household where the amateur photographer does his developing. To keep one's fingers out of the hypo solution, a pair of wooden clothespins with straight-grained strips of wood attached to them, as shown to the right, have been found very useful—and are comparatively easy to make.—*Lester P. Young.*



Hints for the Home Workshop

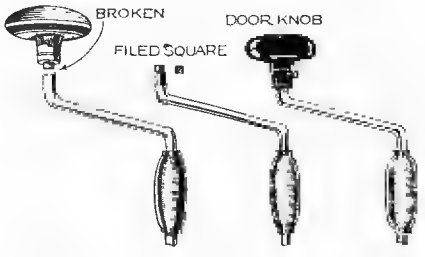
Boring Holes in Hard Wood



BY using a "T" pipe, that is, three pieces of gaspipe fitted together in the form of a letter "T," the bit of a drill will go through the hardest wood with ease. This novel method increases the leverage and enlarges the efficiency of the applied power. This arrangement will offset the difficulty sometimes encountered due to lack of leverage on the part of the drill.—*Louis Andrews.*

Renewing Brace Knobs

OCCASIONALLY a carpenter or electrician will break the knob from a perfectly good brace. He naturally hates to discard it. All one has to do is to procure a glass or porcelain

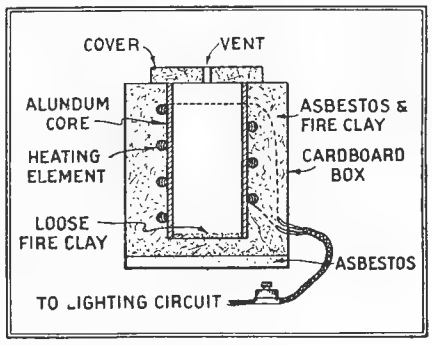


door knob and file the top of the shaft on the brace so that it is four-sided, such as the shaft on a door knob. Then the door knob may be attached to the brace by the screw which is usually used to fasten it on the shaft running through the door. This arrangement has been tried on several occasions in a home workshop and has been found to be of much practical value. We think this method will find much favor in the eyes of the young mechanic.—*Leslie F. Carpenter.*

A Practical Electrical Furnace

A SMALL furnace of the resistance type may be easily built at home, which, with a little care and patience, will easily be suitable for the average amateur. The cost of such a furnace should not exceed two or three dollars at the most.

The materials needed are as follows: About two pounds of dry asbestos, two or three pounds of fire clay, a heating element such as used in an electric stove (the size about 12 inches long



First Prize $10.00

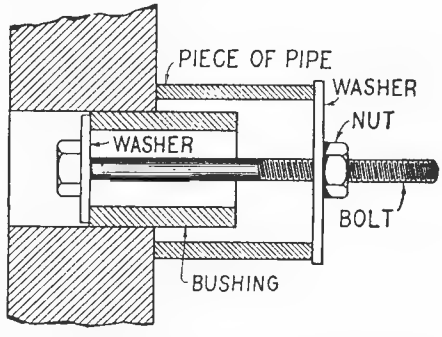
before stretching), an alundum core about 3″ dia. and 6″ long, a small can of water-glass such as is used for preserving eggs.

A cardboard box should first be made from cardboard seven inches square and eight inches deep. Make a mixture of asbestos and water of a stiff, doughy consistency and pack in the bottom of the box to the depth of one-half inch. Mixture of equal parts of asbestos and fire clay, mixed to a stiff consistency with a solution of water-glass and water, make another layer of half to three-quarters inch. The alundum core is placed in the center of the box and connections made with short pieces of copper wire. The connections should be about half way between the core and the side of the box or even outside the entire furnace. Now carefully pack the fire clay-asbestos mixture around the core to about one-fourth inch above its top. After it has dried this excess permits smoothing down to an even top. The top is made by packing a layer of the mixture in the lid of a round mush box, the vent being made with an ordinary lead pencil.

The furnace can be dried out quickly with its own heat. When the furnace is quite dry, smooth the top by rubbing with a flat board and round the corners. —*Wendell O. Rich.*

Pulling a Bushing

GET a bolt with a head larger than the hole in the bushing and smaller than the outer diameter and one which will pass through the bushing. Put the bolt through the bushing with the threaded end pointed in the direction of the moving bushing. Slip a piece of pipe over the projecting end large enough so that the bushing may pass through. Put a nut on the bolt



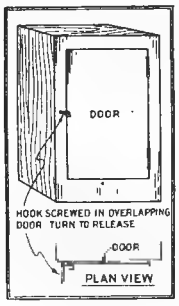
with a washer to keep it from going into the pipe. Now screw the nut with a wrench, applying pressure and gradually pulling the bushing out.—*Leo Placeriar.*

$10.00 MONTHLY FOR BEST HINT

SEND us a photograph or sketch of your own hint for the home workshop. $10.00 is paid monthly for the best hint accepted and published. Others that we publish are paid for at regular rates. Here is a chance for you to win a prize for a useful workshop hint.

WRINKLES

Clothes Hanger as Catch



A CLOTHES hanger or rather clothes hook can be used as a catch on a wardrobe or closet door, which refuses to stay shut without being held shut. — *Henry Buchtel.*

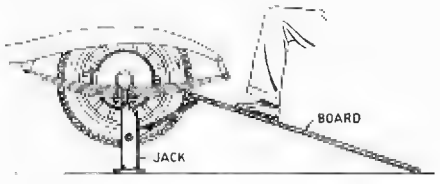
Damp-Proof Mucilage

MACERATE five parts of good white glue in twenty parts of soft water for twenty-four hours. Then add nine parts of rock candy and three parts of gum arabic. This can be laid on with a brush before the labels are used and they will not stick together when dry.—*Miss Emily Dinsmore.*

Emergency Jack Handles

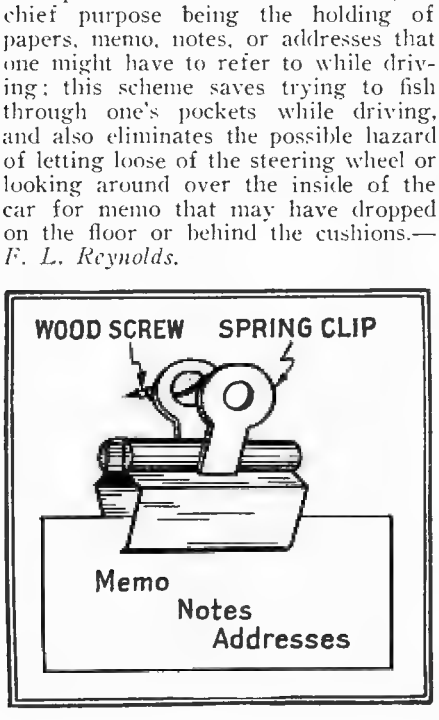
***First Prize*, $5.00**

OFTEN one wishes to raise a car to change a tire, and finds that his jack handle does not reach out far enough for him to get good leverage. If he will place a long board, rail, or even a piece of old pipe over the end of the jack handle and the other end on the ground away from the car he may then, by stepping on the board easily raise the car.—*Wendel B. Nester.*



A Convenient Memo Holder

BELOW you will find sketched a small device I have used for some time on my car; it merely consists of a spring clip screwed at some easily seen part of the interior of a car; its chief purpose being the holding of papers, memo, notes, or addresses that one might have to refer to while driving; this scheme saves trying to fish through one's pockets while driving, and also eliminates the possible hazard of letting loose of the steering wheel or looking around over the inside of the car for memo that may have dropped on the floor or behind the cushions.—*F. L. Reynolds.*



Broom Aids

HERE are two suggestions which will add to the life of the humble broom: Get a rubber cap of the kind used on the ends of crutches, at almost any druggist's and fit this to the top of the broom handle. Then when leaned against a door or wall, it will not slide and fall down, nor will it mark papered walls, varnished woodwork, or anything else with which it comes in contact. The working end is improved with a section of inner tube, selected so as to be a snug fit around the top of the broom part, and with the two upper ends shaped so as to have a hole to go over the handle. This is put on from the top with the two ears of the rubber lapping over one another.—*Mrs. H. E. Chrisman.*

Sagged Doors

IF a door sags and sticks at the bottom front corner, open it wide, take out the screws that fasten the top hinge to the casing and fold the hinge back against the door. Drive a wedge under the door at the bottom front corner. With hammer and wood chisel, or screwdriver, deepen the mortised opening in the casing about 1/16 inch to let the hinge lie a bit deeper. Get some burnt match sticks, drive them into the screw holes and break them off even with the surface. Open the hinge back into place and replace the screws, using screws a little larger and longer if possible. It is well to glue the matches. The hinge should be put in very tight and solid. See that the screws that secure the hinge to door are tight also.—*Fred W. Roe.*

Remove Iodine Stains

A SIMPLIFIED method to remove iodine stains from cloth is first, wet the stained spot with aromatic spirits of ammonia, then add a few drops of hydrogen peroxide. The stain will quickly vanish.—*Fred F. Edwards, Jr.*

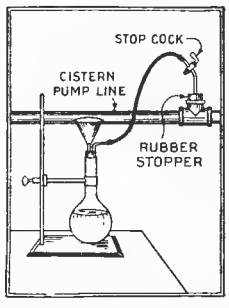
An Ornamental Bowl

DON'T throw away old victrola records. You can make them flexible by heating, and then bend into various shapes, suitable for bon-bon dishes or fruit bowls. The center hole of the record serves as a good point for the exact middle of the bottom. After it has hardened, the bowl may be bronzed and tinted.—*James Dean.*

A Table Pad

TO protect a highly polished table from hot dishes, use a pad of standard plaster board, which costs about 4 cents a square foot. This can be cut into any desired shape or size with a saw. 80 cents will buy enough to cover a dining room table with two extra leaves.—*Thos. P. Milburn.*

Low Vacuum Pump



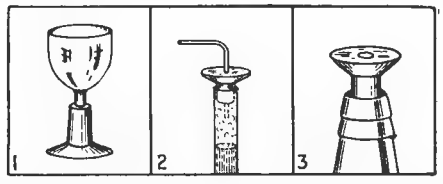
A VACUUM pump suitable for filtering, distilling, and other home laboratory uses can be had if the home is using a cistern pump. Tap the pipe or remove a plug and put a one hole rubber stopper in its place. Insert a small stopcock in the stopper and work the pump until all air is removed from the pipe and water begins to come out. The stopcock may now be opened and regulated to get the desired vacuum. Of course the pump must be worked every so often to expel the air and renew the vacuum. With the stopcock closed, the pump may be used as usual. —*Howard Dietrich.*

Keep Your Eye Glasses Clear

JUST rub eye glasses with a little soap and polish with tissue paper. This will remove steam and prevent their being clouded.—*Mrs. J. M. Fristo.*

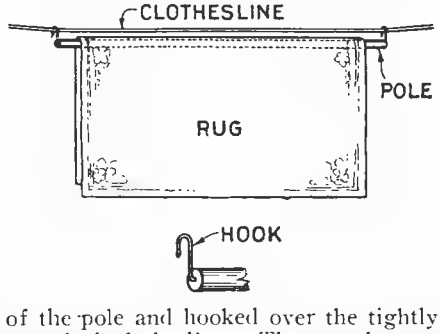
Uses for Spools

AN empty thread-spool, chopped off at one end, may restore a very efficient base to a wine glass, (Fig. 1) or can be used in experiments as a cork for inserting tubings, (Fig. 2) or may be usefully employed as a bottle opener (Fig. 3).—*Seavax Framroze Desai.*



Pole Supports Rug for Cleaning

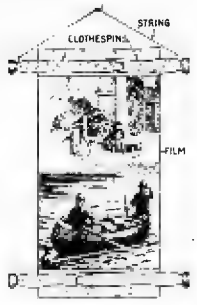
A RUG may be handled easily for cleaning if the pole on which it is rolled when purchased is used as a support, as shown in the illustration. Two stout wires are fastened into the ends



of the pole and hooked over the tightly stretched clothesline. The rug is suspended on the roller and is thus kept straight.—*Alfred J. Kafoury.*

and RECIPES

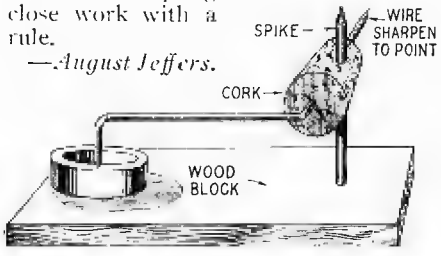
Drying Films



THE drying of photographic film in full lengths without scratching or curling is quite difficult. The illustration shows a simple and inexpensive device constructed of common wood clothespins without any metal pins to come in contact with the film and cause rust streaks. A pair of pins are fastened at each end of the film by pushing one pin over the other which in turn is clamped on the film. A string tied to the heads of one pair of pins provides a way to hang the whole on a nail.—*Alfred J. Kafoury.*

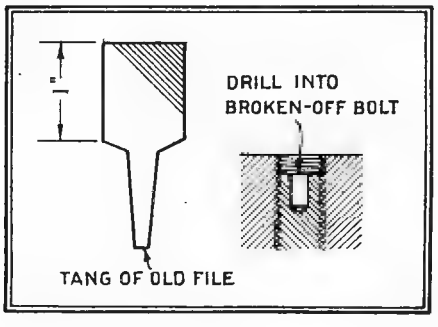
Improvised Surface Gauge

THE needle is simply a piece of wire forced through a heavy cork which in turn is pushed down over a long spike driven through the center of a small block of wood, perhaps four inches square. This device can be made in a few minutes and gives quicker results (also better) than attempting close work with a rule.—*August Jeffers.*



To Remove Bolts and Nuts

AN old file cut off about one inch from the end will prove useful as an "easy-out" for removing bolts and long nuts. Most of us are familiar with the form sold in the stores. All that is necessary to remove a troublesome bolt that is stuck is to bore a hole in it large enough to insert the "easy-out." Tap it lightly and it can be easily turned with a pair of pliers.—*Clyde Snoke.*



To Mend a Crack in Stove

WHEN the stove is cracked, it can be made as smooth as the surface, even though the crack is quite broad. Make a cement with egg, the yolk and white beaten together, a teaspoonful of powdered stove polish, worked into a paste with finely sifted coal ashes. This will also cover holes in stove pipes. The egg cooks making a strong cement that lasts and can be polished when cement is perfectly dry.—*Miss Emily Dinsmore.*

An Easy Repair Method

WHEN some appliance is loose and keeps loosening quickly on account of the screw hole having become too large, proceed in this way.

Remove the screws so as to be able to get at the screw hole. Fill the opening with plastic wood which when it hardens, can be hammered into or sawed. While the plastic wood is still soft, put the appliance in place and screw firmly. Superfluous plastic wood which is putty-like before it hardens in the air, will be forced out and the screws will be held solidly.

The weight of a hanging appliance should be taken off the screws until the plastic wood sets. In many cases the article to be fixed firmly in place, will be held down by its own weight, as the upright metal stand on a stenographer's desk.—*Bruce F. Richards.*

For Nails in Shoes

PAD a nail in the heel of your shoe with cotton wool and fasten with a cross section of adhesive tape. The shoe can then be worn without discomfort.

$5.00

will be paid each month for the best wrinkle or recipe submitted to the editors and which they accept and publish in these columns. All other ideas accepted and published in this department will be paid for at regular rates. Address your ideas to—*Editor Wrinkles and Recipes.*

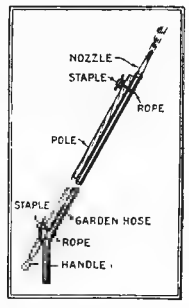
A Simple Wood Preservative

WOODEN fenceposts often do not last long, when set in ground. To make them last, apply the following mixture all over with a brush.

Powdered charcoal with boiled linseed oil—have it the consistency of paint.

It costs but 2 cents apiece to preserve posts in this manner.—*J. Fischer.*

For Washing High Windows on the Outside



TAKE a pole about 14ft. long and make a handle on one end. Take some staples and some rope. Put the piece of rope around top end of pole. Drive in the staples to hold the rope in place. About 6 inches above the handle, take a garden hose and tie the ropes around it, turn on the water and direct the hose.—*Fred Allen.*

Screen for Stemming Elderberries

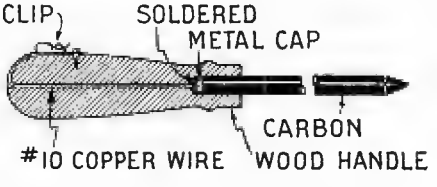
TAKE a foot square of heavy screen such as one buys for frames with ¼ inch size mesh, galvanized is best. Tack on a square frame and lay over a deep crock.

Rub berry stems over this and berries will come off perfectly stemmed at rate of 1 bu. in ten minutes, where a person would otherwise work for hours to prepare a basket for canning by hand.—*Mrs. B. W. Fluker.*

Six Volt Electric Soldering Iron

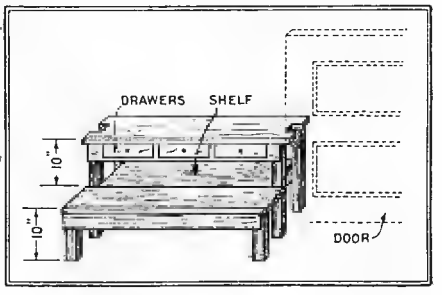
TAKE a carbon core from an old flashlight battery, leave the brass cap on while the other end is pointed.

Solder 10 gage copper wire to top of cap. Then solder the end of the wire to the old battery clip, which is secured to handle by a screw. Counter set clip and wire for a neat job. The wood handle may be turned or whittled out, if you desire.—*Clarence Price.*



Carpenter's Combination Bench

A COMBINATION bench, step and door jack can be easily made from slabs of wood around the workshop. The top step is 20″ from the floor, 12″ wide, and 30″ long. Three drawers for nails may be made underneath it. The lower step projects 10″ and is 10″ high. It is as long as the top step. The shelf on the level with the lower step forms a space for tools. The top step is notched to hold the door or sash while dressing.—*Herman F. Schneider.*

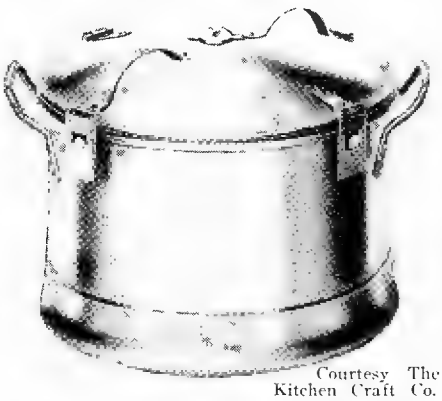


Cook While You Play

By Mrs. Christine Frederick

UNTIL the war new utensils made their way into the kitchen very slowly. Women were not "sold" on the home use of machinery. They didn't like to operate machines and didn't understand them. Servants refused to use these labor-saving devices. I have had some who preferred the washboard to my new electric washer!

But the war and the high cost of servants forced a new order of things. Women are now accustomed to machinery and "new-fangled" methods in the kitchen. They do not fear that a pressure cooker will explode, as they once did; nor are they skeptical of the value of the fireless cooker or the waterless cooker. They perform marvels of efficiency in their kitchens with the aid of modern equipment, and feel perfectly at home using it. They do not have the ideas of an aunt of mine, who on seeing my modern, well-equipped kitchen, said grudgingly, "it's all very up-to-date and all that, but I wouldn't like to cook in it; it seems too much like a machine shop!" She likes her old coal stove, her oil cloth-covered table and her iron pots!



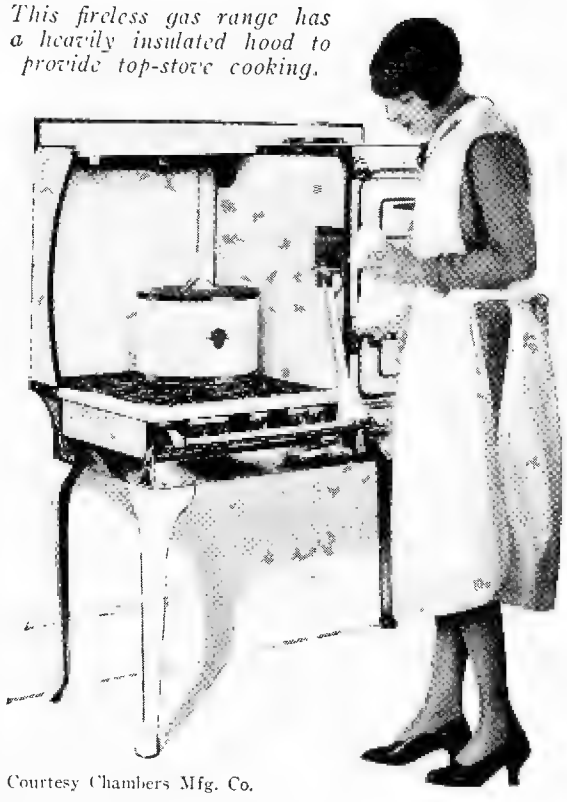
Courtesy The Kitchen Craft Co.

A thick layer of chemically treated asbestos prevents heat from striking the aluminum-bodied waterless cooker directly, and supplies uniform heat.

Just as laundering and sweeping have been revolutionized by modern devices, so has cookery. Every new development is in the direction of less time spent by the stove, less time spent in preparing the food, and a more nutritious and tasteful menu. Not long ago someone started a "society for the prevention of cruelty to good foods," which means that intelligent people realize food should not be mistreated by bad cooking. Nor should the cook herself—so often the wife with many duties and no servant—have to spend so many hours in the kitchen.

What are some of these new aids to cooking efficiency? At the top of the list I should place the steam-pressure cooker and the "waterless" cooker. The steam-pressure cooker brings to the aid of the housewife the physical fact that either steam or boiling water *under pressure* is hotter than boiling water in an open vessel or steam at atmospheric pressure, the more pressure, the higher the temperature. Water boils at 194° F. instead of 212° F. on top of a mountain 10,000 feet high. In a sealed pressure boiler under 25 pounds of steam pressure it boils at 267° F., 55° F. higher than in an open vessel. A pressure cooker therefore saves fuel. A pot roast can be cooked with less than 10 cubic feet of gas, and one shovelful of coal will cook a chicken beautifully. It makes use of a low fire instead of a hot fire. And more important still, tough chickens are made tender and makes of a cheaper cut of meat a delicious dish. Cheap foods, like navy beans, hominy and corn meal mush become cheaper still because of the lower cost of cooking them. Nor does a steam-pressure cooker ever let things burn; no "pot-watching" is needed. Moreover, steam breaks down the connective tissues of the food so that it is more readily assimilated.

This fireless gas range has a heavily insulated hood to provide top-stove cooking.



Courtesy Chambers Mfg. Co.

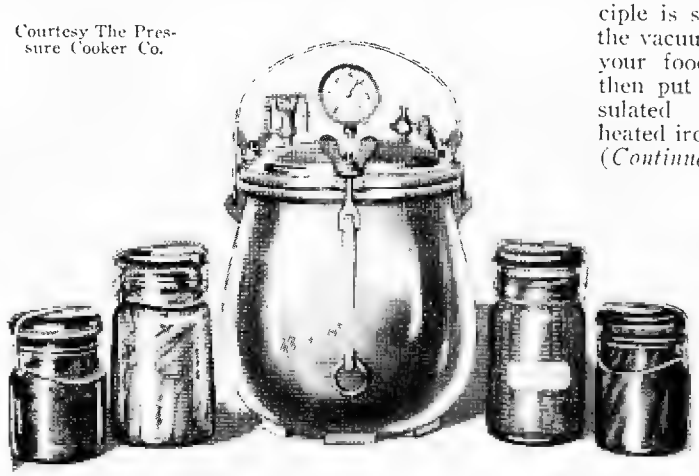
The waterless cooker is another modern marvel of the kitchen. It makes use of the principle that heat and not water is needed for perfect cooking, water being really a detriment to the food—washing out, as it does, the important and nourishing mineral salts of the vegetables.

The waterless cooker has a heavy insulated base which distributes the heat so evenly that it does virtually what the steam-pressure cooker does. The water in the food makes it unnecessary to put any water in the cooker. And the result is that the flavor is not washed out, and tough meats become tender with the slow cooking. You can cook three or four vegetables *all at one time* over *one burner* in a waterless cooker. It saves and provides better-tasting food.

The "fireless" cooker has been with us a long time, but surprisingly few women have used it, although the Indians used it centuries ago. The principle is simple, like that of the vacuum bottle. You heat your foods thoroughly and then put it in a highly insulated box, with two heated iron disks at top and

(*Continued on page* 64)

Courtesy The Pressure Cooker Co.



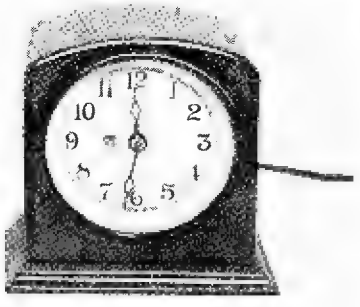
A heavy aluminum steam-tight pressure cooker can be used over any type of fire. This one is vase-shaped to provide space and strength, particularly for canning.

Novel and Convenient Aids to Comfort

Eliminate the Dining Room

BEAUTIFUL French doors open to reveal a table that literally falls from the wall, and benches to either side with collapsible backs. At the close of a meal, these fold up and silently steal away. Such an arrangement will enable you to save space and time, with a combination dining alcove and living-room.

Perpetual Motion, Almost



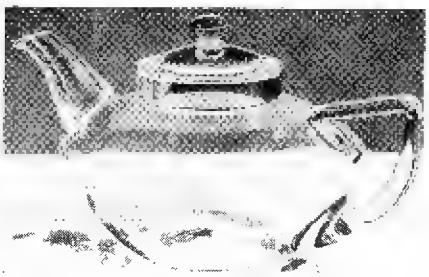
NEVER mind worrying about being late because you forgot to wind the clock. Use this electric one, just start it and it will go as long as you have credit with the lighting company.

Let Your Eggs Time Themselves

COOK your eggs without watching the clock. Just put the eggs inside the bowl (four at a time), and pour a few teaspoonfuls of water into the top porcelain cup. When the current is turned on, the water runs inside and turns to steam which cooks the eggs. When the steam stops, they are done.

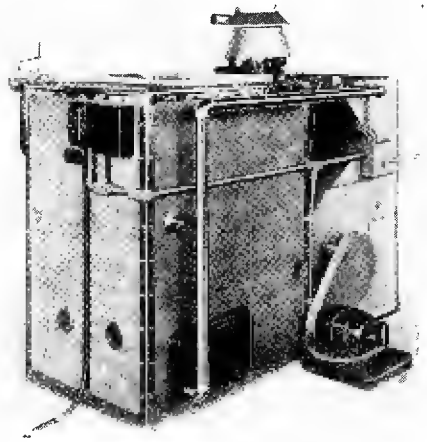
It's a Searchlight

REALLY, he's not taking his fountain pen from his vest pocket—he's taking out the latest flashlight, a *penlight*. If you're tired of lugging the standard-size flash on hikes, if you've searched in vain for the house number on a dark street at night, why not try this young man's brand of lighter? It's equipped with a powerful flashlight, complete with battery and all. You can put it in your pocket, your purse, anywhere.



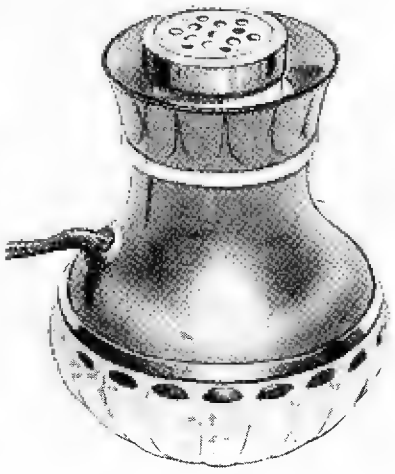
Tea to Taste

EVER wondered why you just couldn't make tea weak or strong enough to suit individual tastes? Or had so many individual tastes to suit? Ever wished you could just see through the teapot? Well, now you can, with this transparent pot, made of heat-resisting glass. Boiling water will not crack it—put in your tea ball or tea and you can just see when it's steeped enough.



Windowless Ventilation

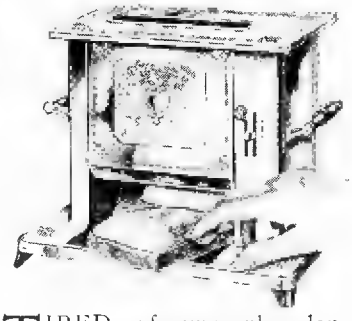
SOUNDS funny, but it's true. This weather-maker works independently of windows and eliminates drafts. Heating is accomplished by gas and circulation by means of an electric blower. It combines four services—warms, filters, humidifies, and circulates air through the house at the same time.



Cigarettes Again!

MANUFACTURERS are certainly turning their attention to making smoking comfortable. This lighter can be used wherever there's access to an electric switch. Just lift the lighter and press your favorite cigar or cigarette against the top—it's lit.

Toast to Order



TIRED of unevenly done toast? Half-done toast? Burnt toast? Well, this device gives you toast as brown and dry as you want it to be. And it's automatic. Press the lever to adjust heat and drop in your bread. When it is done the toast drops down the slide to the tray at the base.

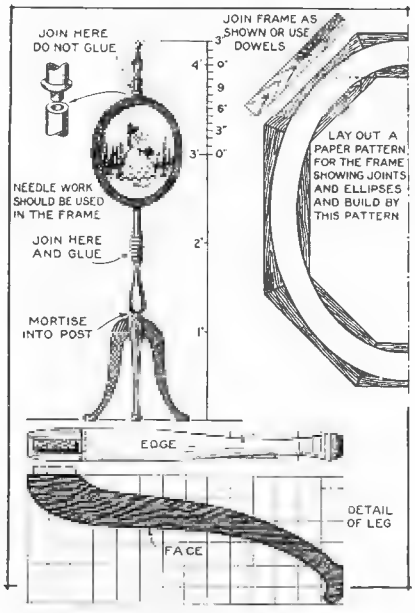
A Pole Screen

Useful, Decorative *and* Easily Made

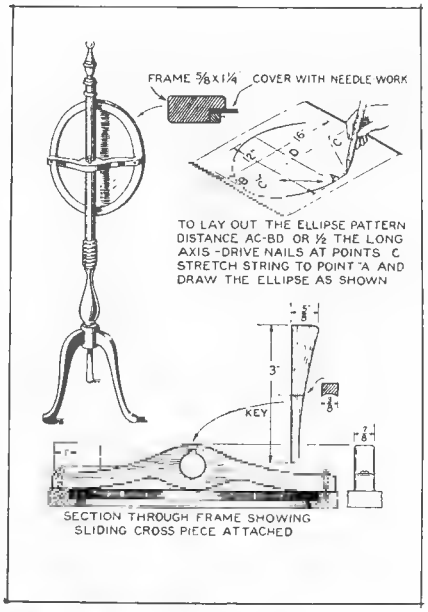
To Give Yourself Comfort as Well as Warmth, Follow These Constructional Details

By H. L. Weatherby

On chill spring nights, this charming pole screen will protect your face from the too warm rays of your open fire.



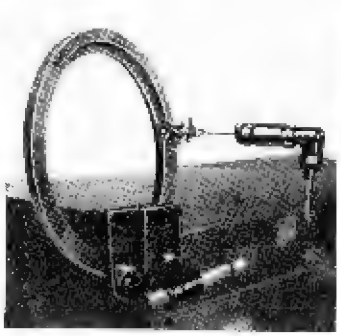
Detailed layout and dimensions for this beautiful screen are shown to the left and right

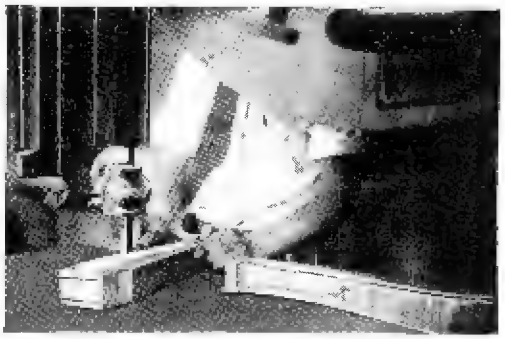

FRAME ⅝ x 1¼ COVER WITH NEEDLE WORK
TO LAY OUT THE ELLIPSE PATTERN DISTANCE AC-BD OR ½ THE LONG AXIS - DRIVE NAILS AT POINTS C STRETCH STRING TO POINT "A" AND DRAW THE ELLIPSE AS SHOWN
KEY
SECTION THROUGH FRAME SHOWING SLIDING CROSS PIECE ATTACHED

TO quote from a book on antiques: "The pole screen was designed to protect the fair lady's face from the devastating heat of the open fire."

The construction is easy to follow from the drawings. The frame is designed for a choice needle-work design which originally was done on black satin in cross-stitch. The frame, however, can be used with a small tapestry, a bit of oriental embroidery, or even an etching or other type of picture, and may be square or rectangular in shape. It is entirely possible to buy the frame ready-made from houses specializing in picture frames; but for the craftsman who desires to make his own, the methods shown for the oval frame will prove highly satisfactory, and the work involved will well repay the builder.

Jointing and building the frame will be rather difficult and can best be done by working from or over a full sized paper pattern showing all joints. When the joints have been carefully fitted, all the pieces should be clamped to a perfectly level surface, such as the bench top, and the gluing pressure applied to the joints with bar clamps. Plain butt joints are not strong enough, and should be reinforced by lapping the pieces. Dowels, if carefully fitted, will strengthen the sections. After the frame has set, the outline for the two ellipses should be drawn, and the frame cut to shape. This can be done by hand, but a jig saw or a bandsaw will be a big aid.





It is a simple matter to cut a rabbet in the frame of the screen as shown at the left. A bandsaw can be used to cut the desired curves in the legs

The rabbeting of the back is clearly illustrated. After boring to the correct depth, the rabbet should be smoothed out with a chisel, the outside and inside of the frame filed smooth and well sand-papered.

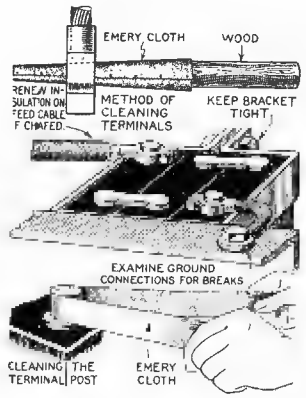
The next most difficult feature of construction is shaping the legs. The method is illustrated. Each leg calls for two sets of cuts with a turning saw, after which considerable smoothing with file, scraper, and sandpaper is necessary. Fitting the legs into the post requires tenons or dowels with concave shoulders on the leg pieces.

From his own experience in building the pole (*Continued on page* 82)

Helps for the Owner *and* Driver

If You're Interested in Your Car, You'll Find These Articles Invaluable.

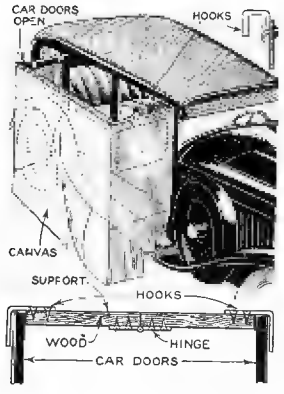
By George A. Luers



Doctoring the Battery

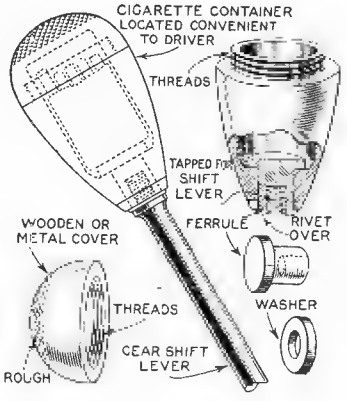
SO many instances of car failure are attributed to defects in battery care, that it is well to check up periodically to avoid trouble at some inconvenient time and place. The cleaning of terminals is important. The tightness of the battery in the bracket is an item that should not be neglected. The ground lead should be unbroken and the connections tight. The main feed cable should be free from chafing and properly insulated. There is no better time to check up on the battery than in the Spring.

For the Old Swimming Hole



MANY times the motorist and friends could enjoy a Saturday afternoon or Sunday swim if dressing facilities were more convenient.

A three sided canvas closure is made to be supported by the closed car doors. The canvas extends from the tops of the doors to the ground. A folding wooden support for the outside edge is made to hold the doors open. Hooks on the canvas provide for hanging the canvas. Stowage is simple as the canvas folds and may be carried under a seat, along with the folded prop. The car is kept clean and dry when this is used.



Reach for a "Lucky" Instead of a Gear Shift

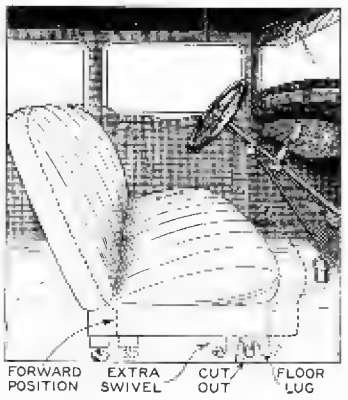
A CASE for carrying cigarettes, convenient to the driver, is one consisting of a gear shift container right at the driver's hand. This arrangement permits of handling cigarettes while driving, without detracting from observations of the road ahead.

The container shown by the drawing was made from wood, fashioned similar to a hand drill handle; that is, the part in which drills are carried. The top of the container is roughened for the striking of matches.

Helping the Little Folks to Drive

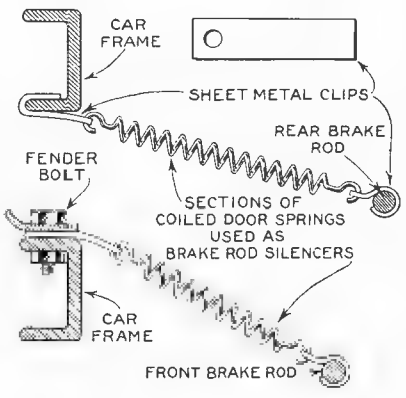
TO provide adjustability of the seats of a coach, so that the smaller members of the family could drive the car, one owner made the alteration shown below.

In this alteration the front seats are fitted with extra swivels several inches to the rear of the regular equipment. The lugs on the floor were slotted so



the seats could be lifted and placed quickly on either swivels. The forward position brings the driver closer to the pedals, steering wheels and controls, allowing shorter persons to drive the car freely. Additionally, when one or both seats are moved forward, the foot room for the rear seat passengers is greater.

If Brake Rods Rattle—Try This



WITH the four-wheel brake system, the additional brake rods produce more than usual noises, especially after the links and supports are worn enough to rattle.

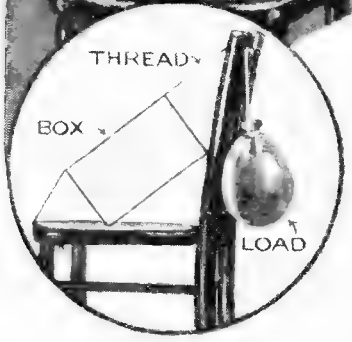
Silencing of brake rods is possible through use of coiled springs fastened jointly to the rods and car frames.

Springs such as are used for screen doors are servicable and cheap. Sections of these attached by pieces of sheet iron, cut off, punched and bent to form hooks, make effective silencers.

Two will be required for the emergency brake rods, two for the foot front brake rods and two for the foot rear brake rods.

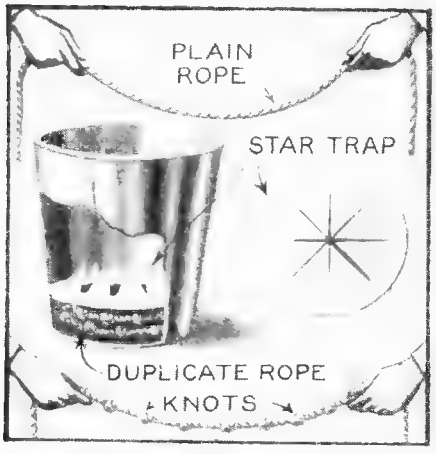
MAGIC

By Dunninger*



Spirit Ropes

THE magician passes an unprepared rope for inspection. He then shows a pail, unquestionably empty. He then slowly drops the center of the rope into the pail and asks two spectators to hold the ends. After a bit of by-play, the rope is removed and found to be knotted. The secret lies in the fact that a star trap is formed in the bottom of the pail. This permits the plain rope to be exchanged for the knotted rope. The audience does not observe that the plain rope is concealed by the magician for but a fraction of a minute.

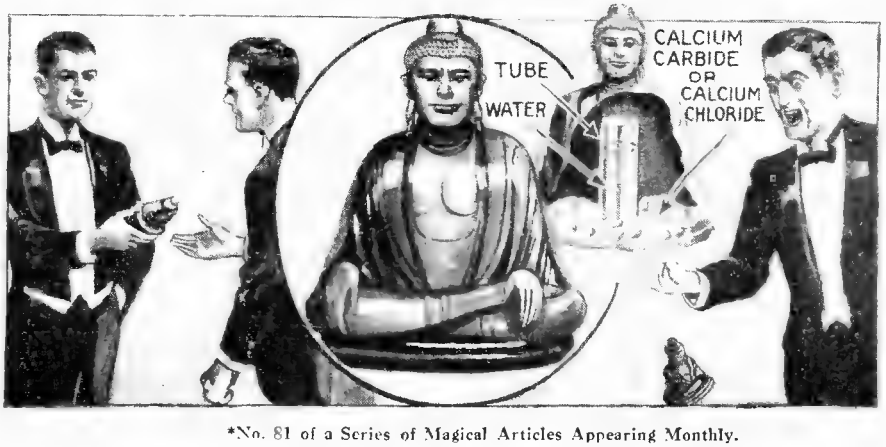


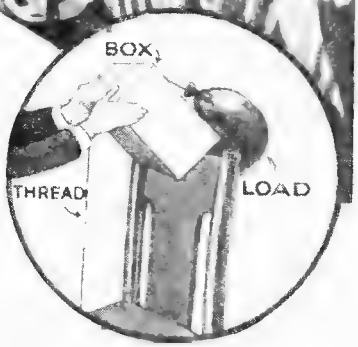
New Production Box

A BOX with no top and the bottom working on hinges is exhibited for examination. It is entirely empty and quite unprepared. The magician lets down the flap so that everybody can see through it; then, replacing the bottom, puts the box on the seat of a chair. He then lifts the box and promptly proceeds to withdraw yards and yards of ribbons, flags, silks and a large white rabbit. Secret: The load is contained in a black bag suspended in back of a chair as shown. As the box is lifted, the load is hoisted into place.

The Enchanted Buddha

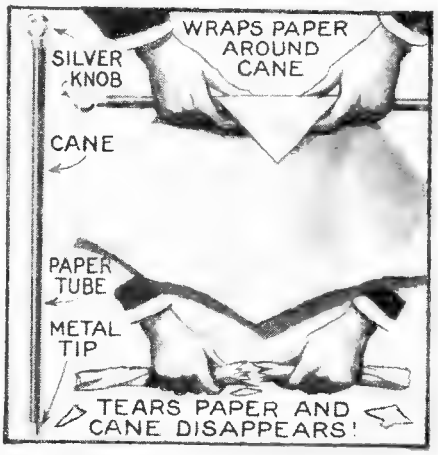
THE magician shows a small brass Buddha which possesses enchanted properties. He claims that if it is held by an unbeliever it becomes intensely hot. To demonstrate he gives the Buddha to a spectator, who drops it with an exclamation of surprise. The magician then suggests that someone else pick it up, but the attempt is usually not made. The secret lies in the fact that the Buddha is mechanically constructed, the bottom of the figure being threaded to fit tightly. Near the top a small perforation is made to allow the gases to escape. A tube for water is soldered to the bottom and the surrounding area is heaped with calcium carbide. Chemical reaction started by tipping the figure produces the heat.





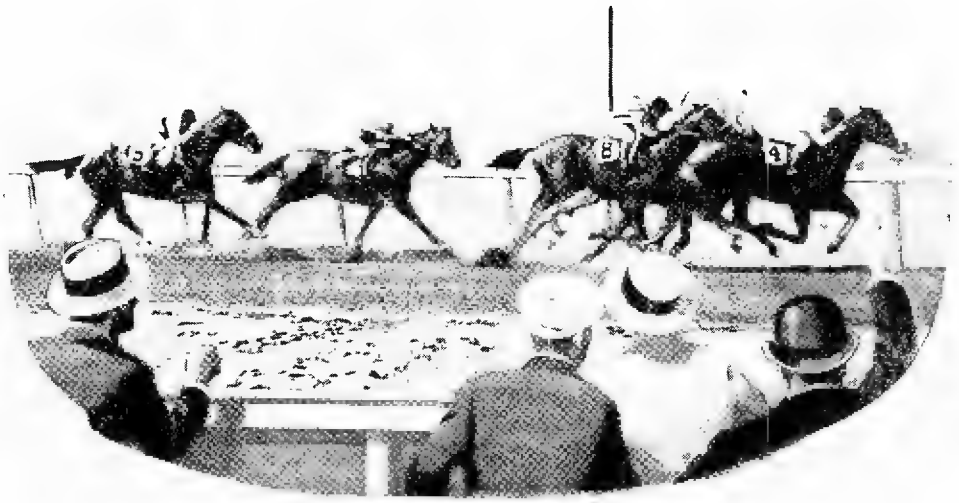
The Vanishing Cane

THE magician enters, sporting a high-polished ebony walking stick. As his assistant is not there to take the cane, he removes a sheet from an ordinary newspaper and, beginning with one corner of the newspaper, he wraps the cane up. When completely covered, he tears his parcel to pieces and rolls the remnants between his palms. Secret: The cane is made of paper, painted to give it an ebony appearance. The tip and knob are genuine. When rolling up the cane in the paper, the two ends are vanished and the entire is torn up.



*No. 81 of a Series of Magical Articles Appearing Monthly.

Solve *these* Brain Teasers *and* Win *a* Prize



By Sam Loyd

THE Puzzle King presents the fifth of a series of problems, the solving of which will show if your mathematical ability is bolstered up by logical reasoning. Prize winners of the February puzzles will be found listed on page 64.

Twenty-five Dollars in Prizes

A FIRST PRIZE of $10 will be awarded to the person sending correct answers to the two puzzles *accompanied by the best expressed analysis of the Horse Race Problem.*

A SECOND PRIZE of $5 will be awarded for the next best analysis and correct answers to the two puzzles.

TEN PRIZES of $1 each will be awarded to the ten persons who send the next best analysis of the Horse Race Problem, together with correct answers to the two puzzles.

Answers must be received not later than noon, May 15th, addressed to "Puzzle Editor," SCIENCE AND INVENTION, 381 Fourth Avenue, New York City.

All contestants must abide by the decisions of Sam Loyd, who will examine all papers and award the prizes.

Papers of identical merit, tying for any one of the prizes, will each receive the full amount of the prize tied for.

"A Game That Can't Be Beat"

BOOKMAKERS, in offering the public opportunity to back their choices at the racetracks, naturally take measures to assure themselves profits.

The collective chances of the horses in a race, of course, represent 100%. For example, in a three-horse race, where the candidates are considered of equal merit, each would have 1 out of 3 chances, or 33 and 1/3%. The odds should be 2 to 1 against each entry.

Calculating "bookies" sell anywhere from 110 to 150%, instead of the 100% which exists. Thus they acquire an advantage over the bettors of from 10 to 50%, to start with. For example, the odds of a 150% book in a three-horse race, might be even money against each horse.

Now, let us see who understands the bookmakers' methods, by working out the following proposition:

In a five-horse race, a bookmaker offers $2 to the bettor's $1 on the horse A. On horse B he offers 3 to 1. On C he offers 4 to 1. On D he offers 5 to 1. If he wants to make a 125% book on that race, what odds must he offer on the fifth horse, E?

Scissoring Linoleum

MRS. SIMPKINS brought home a piece of linoleum from the big fire-sale, and after her good man had scissored out the damaged sections, the salvaged piece appeared as in our sketch.

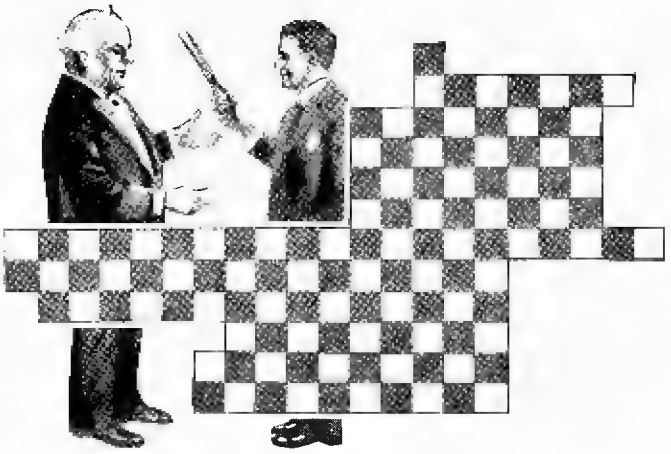
"There, that will repave the kitchenette nicely," chirped Mrs. S.

"Oh, yeah," gloomed Simpkins, "Well, if you can cover a square floor with that jig-saw remnant, I'll cable Einstein that you have proved his Fourth Dimension theory to be O. K."

Now, the situation is not so hopeless as Simpkins implies.

First, counting the little squares, we find them to total 121; just enough to form an 11 by 11 square; so the problem resolves itself into the question: What is the least number of pieces into which the remnant can be divided in order to construct an 11 by 11 square, and preserving the pattern of alternating dark and light squares?

Utilize the printed diagram, or a copy of it, to demonstrate your solution, and above your constructed square state the number of pieces in its composition.



THE SAFETY

Conducted by

Readers' Opinions and Comments

Magnets For Defective Eyesight

I HAVE recently read an old book on Suggestive Therapeutics in which the author has advocated the use of an electro-magnet for the cure of defective eyesight.

It stated that color blindness and near sightedness were effectually cured in a Paris hospital through this means.

I would like to have your opinion on the authenticity and efficacy of this, to me, novel idea.

If it is effectual, I would like you to print a diagram of such a magnet along with full constructional details, as I am sure it would be of interest to many of your readers.

I am a constant reader of SCIENCE AND INVENTION, and would be greatly obliged for this information.

FREDERIC SHELLEY,
Philadelphia, Pa.

(It has been quite definitely proven that magnetism, per se, has no effect on the human organism. It is not and cannot be of benefit to the eyesight and will not in any way cure defective eyesight.

Where a psychic factor is involved, faith in any form of a cure-all, whether that be a magnet or the hind foot of a rabbit may aid the individual in regaining health. The quack's greatest asset is the testimonial letters that he receives, so no doubt there are testimonials backing up magnetic devices for all sorts of ills. EDITOR.)

Stop Medical Frauds

IN the December number of your magazine I read an article by a reader claiming your attacks on fraudulent "curative" devices are not justified. In my opinion, this man must be a crook himself, or he has been bitten badly by one and his disposition is such that he would like to see others share his own fate. Misery loves company.

In my case I have been defrauded a number of times with cure-all devices, but I don't care to see others defrauded. The people who buy these devices are usually poor. They spend their hard-earned money looking for help and can ill afford to be swindled by crooks. I am glad that there is such a magazine as yours, that has backbone enough to expose these wolves in sheep's clothing. I only wish there was an organization that would round them all up and send them down to the hottest part of Satan's kingdom where they will eventually arrive.

TOM J. CLARK,
Willows, Sask., Canada.

(It is only because the vast majority of our readers believe as you do about the work of our magazine that we have maintained a ruthless campaign against fraudulent systems and practices of all kinds and we intend to continue doing so. EDITOR.)

Suspended Animation

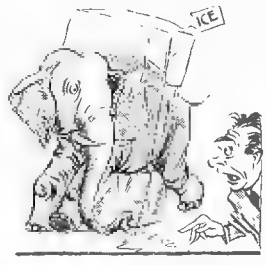
I AM only seventeen, but your Science Questionnaire has helped me out a great deal in my biology, physiology and physics classes at High School.

I have a few questions that I would like to have answered.

1. Would you give me an outline on what work or experiments have been done in the way of suspended animation?

2. Can you give me any information (such as drawings, etc.) that will give me some light on the fourth dimension?

ALVIN FICKEWIRTH,
Los Angeles, Calif.



(Quite a number of experiments have been conducted along the lines of suspended animation. About five years ago the editors of SCIENCE AND INVENTION *Magazine took some gold fish, eels, and various other animals and attempted to freeze them in blocks of ice in refrigeration machines.*

Our experiments indicated that these animals, when frozen in ice, did not come back to life after they were thawed out. As a result of the publication of this article, a great many letters were sent to the editors, stating that persons had actually found fish frozen in ice and after cutting them out of the ice and melting the ice, the fish came back to life. The subject is still open for discussion. There is no other way of suspending animation other than perhaps by the use of narcotics, which render an individual comatose.

It is impossible to portray the fourth dimension in the form of drawings, unless you intend to use time as a fourth dimension. If we move a point we produce a line. If we move this line at right angles to itself, we then produce a plane, either rectangular or square in shape. If we again move the plane at right angles to itself, we produce a solid. Now, in order to be absolutely correct in our form of reasoning, we would have to move this cube at right angles to itself to produce a figure of four dimensions. Our limited understanding does not permit us to grasp the situation.—EDITOR.)

More Chemistry?

I AM a constant reader of your science magazines and would like to see the chemistry section grow a little more. How about some more short wave articles? I know most of the readers who like adventure and thrills are interested in them.

In the November 1929 issue of SCIENCE AND INVENTION John P. advanced the thought that perpetual motion exists in the molecule. This maybe true, but a more visible example than that is the celestial bodies; yet this is not a terrestrial machine and I am not submitting it in the contest.

M. F. RAWLINGS,
Sanford, Texas.

The Radium Cure-Alls

FOR some time I have been contemplating purchasing a container for water which would charge the water with radium emanations. Drinking its contents is supposed to improve the secretions from the various glands in the body and in this way help an invalid to regain health. Can you also give me any information regarding radium pads and the like? Are they beneficial?

G. WINTERS,
Philadelphia, Pa.

(For more than five years SCIENCE AND INVENTION *Magazine has contended that radium given in large enough doses to improve the human constitution can also do harm. On February 4th, the United States Department of Agriculture issued a press release headed "Concoctions claiming to contain radium are fakes in many cases." One of the radium water crocks which was examined was found actually to charge the water and produce radio-activity, but in order to get a minimum daily dosage of radio-activity, it would be necessary to drink 1,957 gallons of water each day. Such articles as hair tonics, bath compounds, tissue creams, tonic tablets, face powders, ointments, mouth washes, demulcents, healing pads and other preparations in solid, semi-solid and liquid forms were examined for radium content.*

It must always be remembered that radium in active dosage should only be administered under the guidance of a physician who is trained in its application. Our advice is to keep your hands off anything advertised as containing radium, whether it has a small or large quantity or none of that element in its composition.—EDITOR.)

Increase Perpetual Motion Prizes?

IF you think that perpetual motion, as you call it, is impossible, why don't you double or triple the reward that you now offer? By the way, it hasn't appeared in the last issue of the magazine. It is possible that you are getting cold feet? I have another plan. Why don't you offer a large amount of money, say $50,000.00, with the understanding that upon commercialization of such a machine you are to receive your money back or ten per cent of the profits, the choice resting with the inventor! Place the whole thing in third hands, so that

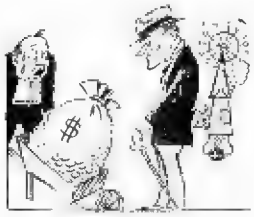
VALVE

Joseph H. Kraus

Will Be Welcomed by the Editors

there won't be anything that might look phoney about it.

The writer has something up his sleeve and it isn't that he wants your money that he writes this; he needs the money to begin with and is trying to make sure he doesn't get cheated out of anything.



This is all for the present—you will hear from me again.

N. C. T.,
New York City.

(The SCIENCE AND INVENTION *prize of $5,000.00 for viewing a working model of a perpetual motion machine has two purposes. The first is to give to the inventor of a working model, coming within the contest conditions, a sufficient sum of money to enable him to patent the device in the United States and in foreign countries. The second and equally as important, is to limit the sale of shares of stocks in mechanisms that do not exist and that cannot be made to operate. We are in no way interested in the outcome of the invention, and desire no rights to the patent.*

We have no desire to increase the monetary prize award so that inventors working along these lines can dangle a large prize before the eyes of suckers, and use it as an argument for the selling of stock. Every magazine that circulates through the mails is duly obligated to pay any awards publicly announced. Failure to do so might mean the loss of entry in the Post Office Department, which would amount in financial loss to a great deal more than the prize itself.

When a magician has something up his sleeve, he shows it. It is up to you now to build your working model and demonstrate the same.—EDITOR.)

You Are Welcome

I AM slightly late in acknowledging the fact that you awarded me the fourth prize in the Dunninger Buzz Saw Illusion Contest.

So I am taking this opportunity to thank both Mr. Dunninger and you for your consideration. Needless to say, it was greatly appreciated by me.

NELSON C. HAHNE,
Dayton, Ohio.

Tear Gas

IN your January issue, a question as to the technical name for tear gas. The question was No. 2345 and your answer was 'benzyl bromide.'

While the same common name is often applied to two or more different chemical compounds, the writer believes that for the most part a different chemical compound is known as tear gas.

This compound is 'chloropicrin.' Its methods of preparation should not be attempted by one not experienced in the realm of organic chemistry. Also, it is not a very pleasant compound to handle.

This gas, 'chloropicrin,' is used very extensively as a fumigating material. The liquid, rapidly vaporizes and fills infested areas, penetrates all storage spaces, even packaged goods. The results are that very little insect life is left.

The writer subscribed to your magazine about two months ago. I find it a very interesting and instructive book. My boy, who is twelve years old, reads it too. And you know the results, when he reads stories about space being curved, under the ocean in a bell, and the like, there are a million questions.

LAWRENCE MAHLER, Chemist,
Clinton, Missouri.

(We wish to thank you very much for your kind compliments and appertaining to your reply on the subject of tear gas, would advise as follows:

During the early part of the war, benzyl bromide usually mixed with bromoacetone was used as a lachrymator. This material was not pure benzyl bromide, but the reaction product of bromine upon xylene. It was known as "Green T Stoff" by the Germans and while relatively non-toxic, French troops were rendered unconscious by it during certain bombardments in the Argonne in the Summer of 1915.

It was not until the spring of 1917 that reports came from the Italian front that the Germans were using a new type of tear gas that also caused vomiting. Analysis later proved this to be chloropicrin.

There are many lachrymators, the most powerful of which is bromobenzyl cyanide and the least powerful of which is chloropicrin. They are listed in the following order:

Bromobenzyl cyanide, Martonite, Ethyl Iodoacetate, Chloracetone, Xylyl bromide, Benzyl bromide, Bromo ketone, Bromoacetone, Chloropicrin by Major General Amos A. Fries, former Chief of Chemical Warfare Service and Major Clarence J. West in their book, Chemical Warfare.—EDITOR.)

Health Shoe Plates

I HAVE seen devices such as electric belts, electric insoles and the like made of copper and zinc strips advertised for sale, that were supposed to cure various ailments. A friend of mine tells me that he has been able to grow a new head of hair by wearing electric heel plates. Is there any truth in such a statement?

JOSEPH C. BALL,
London, England.

(Perspiration cannot strictly be considered an electrolyte of a strength to produce a good current from a copper and zinc plate. Dry feet will produce no current. Even if current is produced, the pressure is about one volt and the resistance of the human body is such that the amount of current would not even register on the most sensitive milliammeter made today. There is a good deal more current generated by muscular movements, or by the beating of the heart than could be produced by a pair of heel-plates. On January 29, 1930, the Postal Department exposed another group of these heel-plates which were supposed to be health appliances and issued a fraud order against the Electrifiable Company of Atlanta, Georgia, which had been selling metal heel-plates to be worn in the shoes and which were alleged to cure a number of diseases by raising the temperature of the blood by an electrical effect. Experts found the heel-plates to be absolutely worthless. The photograph here shows D. F. Angier, Postal Inspector, examining a pair of these plates.

Postal Inspector D. F. Angiers examining heel plates against which a fraud order was issued by the Postal Authorities.

We would advise you not to purchase any products of this general type. They are worthless.—EDITOR.)

Garlic Winners

PLEASE let me add my ideas to those outlined by J. G. Q. pertaining to "Other Contests" in the January issue. I don't want to suggest anything in particular, because I think that has been your failing in the past and up until now. Model-making is a fine thing, but what is the fellow going to do that can't afford to equip a shop for such things? Just one small lathe means a lot of money for the average person. And then, I have a suggestion regarding the prize. I believe my suggestion beats J.G.Q.'s. The loving cup is absolutely useless. A bouquet of garlic blossoms would do as well. A microscope would be much better, but what would a lot of people want with it? For the most of us it would be a great curiosity and that is all.

(Continued on page 76)

Let's Laugh

ALL jokes published here are paid for at a rate of $1.00 each; $3.00 is paid for the best joke submitted each month. Jokes should be scientific. Write each joke on a separate sheet of paper and add name and address to each sheet of paper.

NO WONDER

ENGLISHMAN TO AMERICAN — In England we have a building that's so big it takes three hours to go through it.

AMERICAN—That's nothing. We have bigger buildings than that. I know someone who went into a building ten years ago and hasn't come out yet—and it's called the "pen."

—*Charles Osborn.*

WELL PAID

An ancient automobile chugged painfully up to the gate of the races. The gatekeeper, demanding the usual fee for cars, called, "A dollar for the car."

The owner looked up with a sigh of relief. "Sold," he said.

—*Bernard Proctor.*

HE'S RIGHT

PROFESSOR—When were you born?

STUDE—April 2nd.

PROFESSOR—Late again!

—*Joe Sterling.*

PAGE WEBSTER!

Doc—Your son is suffering from voluntary inertia.

MOTHER—And Joe said he was just lazy.

—*Eunice Beard.*

UNDER PROHIBITION

CHEM. PROF.—If you put some yeast in a mixture of honey and water and let it set in your house for a week, what would be the result?

STUDENT—A raid, $1,000 fine, and 90 days. —*Burt Knutson.*

THAT BATTERED LOOK!

First Prize $3.00

SCIENCE TEACHER—Exercise kills germs.

BOY ON BALL TEAM—How do you get them to exercise?

—*Mrs. J. R. Carson.*

A LONG CIRCUIT

SWEET YOUNG THING—Why don't you turn on the electric lights?

SUAVE SHEIK—I have, but you see it's like this. The power house is so far away it takes a bit of time for the electricity to arrive.—*L. F. Carpenter.*

TRUE ENOUGH

1ST FLAPPER — I'm taking a mail order course in typing, do you think it will do me any good?

2ND FLAPPER—I guess so, I've made a lot from taking male orders.

—*Clyde Snoke.*

NEVER MIND EAR-MUFFS

It was necessary to decide for taxation purposes whether a border farm lay on Canadian or United States territory. Surveyors finally announced to the old lady who had just purchased it, that it just came within the American side.

The old lady smiled with relief. "I'm so glad to know that," she said. "I've heard that winters in Canada are terribly severe." —*Louise Wright.*

ANY APPRECIABLE DIFFERENCE?

LAYMAN—I don't believe all this talk about these mechanical robots.

ENTHUSIASTIC SCIENTIST—It's all true, man—why in a few years I expect they'll be running for president of the United States.—*M. S. Batson.*

BOTH GET HOT

JIM—What is the difference between phosphorus and a match?

JOHN—Well?

JIM—One gets lit when hot, and one gets hot when lit. —*Robert Klink.*

ARITHMETIC LITERALLY APPLIED

Jack's mother looked out of the window and saw Jack holding his pet rabbit by the ears, saying, "Two plus two!"

"Why, what are you doing, Jack?" she cried.

"Well, our teacher said that rabbits multiplied rapidly and this dummy can't even add." —*Mrs. Pearl Blari.*

TRY IT

HE—What can you put in a barrel to make it lighter?

SHE—And wot?

HE—Why, just fill it full of holes.

—*Jack Eedes.*

AN APPROPRIATE DEFINITION

TEACHER—Billie, what's your father's occupation?

BILLIE—He's a worm's substitute.

TEACHER—What on earth is that?

BILLIE — He bores holes in furniture for an antique dealer. —*Vernon Field.*

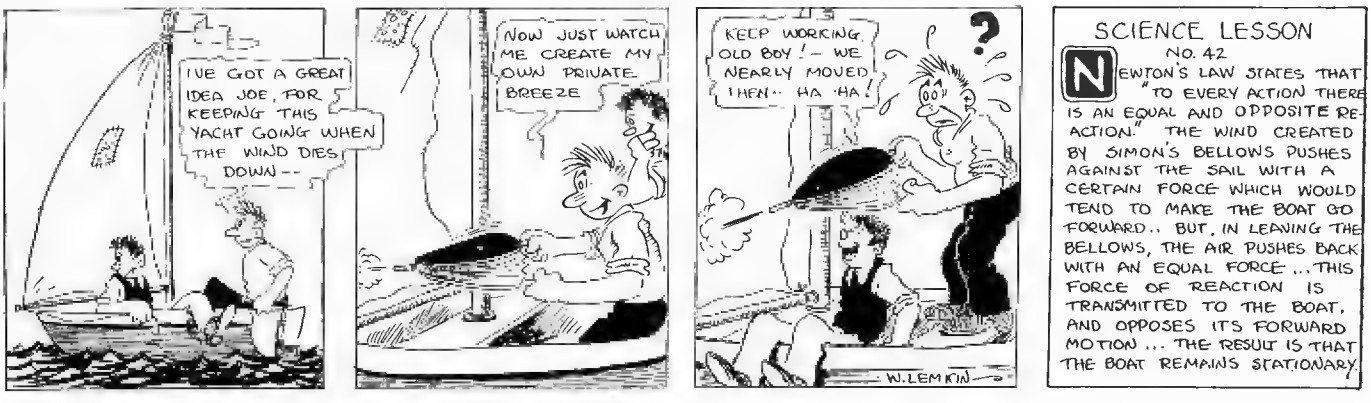
CORRECT!

SCIENCE PROF.—This gas is deadly poison, what steps would you take if it escaped?

BRIGHT STUDENT—Long ones.

—*Paul Arduin.*

Scienty Simon—*Scientist*


I'VE GOT A GREAT IDEA JOE, FOR KEEPING THIS YACHT GOING WHEN THE WIND DIES DOWN--
NOW JUST WATCH ME CREATE MY OWN PRIVATE BREEZE
KEEP WORKING, OLD BOY!- WE NEARLY MOVED THEN-- HA HA!
?
W. LEMKIN
SCIENCE LESSON
NO. 42
NEWTON'S LAW STATES THAT "TO EVERY ACTION THERE IS AN EQUAL AND OPPOSITE REACTION." THE WIND CREATED BY SIMON'S BELLOWS PUSHES AGAINST THE SAIL WITH A CERTAIN FORCE WHICH WOULD TEND TO MAKE THE BOAT GO FORWARD.. BUT, IN LEAVING THE BELLOWS, THE AIR PUSHES BACK WITH AN EQUAL FORCE ...THIS FORCE OF REACTION IS TRANSMITTED TO THE BOAT, AND OPPOSES ITS FORWARD MOTION ... THE RESULT IS THAT THE BOAT REMAINS STATIONARY

Mr. Loyd Solves An Intricate Problem

(2353) Harold Keller, Portland, Oregon, writes:

Q. 1. I am enclosing a problem which

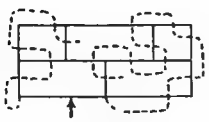


FIG. 1

FIG. 2

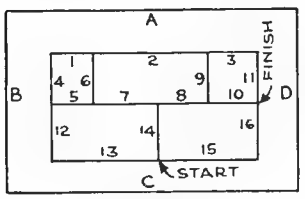


FIG 3

I have been unable to solve. Could you tell me whether or not this problem has a solution.

A. 1. According to Mr. Sam Loyd, our puzzle expert, this problem cannot be solved. He sent us the following reply:

"Originally the puzzle was called the 'Brick Problem' and was presented as follows (Figure 2):

"Directions: Copy the design by drawing three separate, continuous lines which do not cross one another at any point.

"The proposition seems simple enough, and the fact that an endless variety of 'tries' comes within an ace of accomplishing the feat kept people at it for many a long day. Of course, nobody succeeded, for the reason that analysis proves that the design containing eight odd junctions requires four separate lines in its construction.

"A rule applying to continuous line designs established that while there may be any number of points where an even number of lines comes together, no continuous line which does not cross can produce more than two junctions of an odd number of lines.

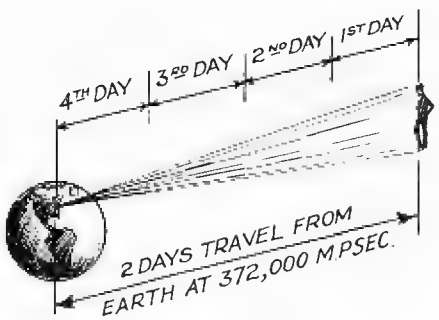
"Rule: Disregard the even junctions, count the odd ones and divide the total by two—the result will be the number of lines required.

"It will be seen that the line goes through the section where the arrow is pointing, rather than across (Figure 1). In my own answer to the puzzle, I prefer to resort to a method of folding the paper and consistently 'go through' all sixteen sections, thus reproducing the design with a continuous line. There it is (Figure 3).

"Directions: Cut out rectangle A-B-C-D and proceed as follows: Start from arrow and trace short line 14. Hold pencil at point between 7 and 8 and fold edge A over to line 5-7-8-10. Continue pencil line over on folded end A and carry to point between 8 and 10. Hold pencil on point and move folded edge A to line 1-2-3. Trace line 9 and continue over folded edge around to point between 1 and 2. Trace line 6 and hold pencil at point between 5 and 7. Move edge A to line 5-7-8-10. Continue line over on fold and carry it to point between 4 and 12. Now flatten out fold, it having served its tricky purpose. We have now described lines 6, 9 and 14, and pencil has not been lifted from the paper. Now trace lines 5, 7, 8, 10, 16, 15, 13, 12, 4, 1, 2, 3 and 11 and the design is complete.

"Like the old 14-15 Block Puzzle, the fascination of this tracing puzzle lies in the fact that the variations are endless and sufficiently close to the desired result to keep one everlastingly at a hopeless task, unless, like Alexander the Great, in his cutting of the Gordian knot, we use original strategy."

The Oracle



Einstein Again

(2354) George S. White, Chicago, Ill., writes:

Q. 1. Is it quite true that if a man were projected from the earth at a speed twice that of light, after two days' flight he would be looking back on the earth at events which occurred four days previously?

A. 1. According to Mr. Einstein, such a state of affairs would occur. He claims that time is not relative. That events pass on our earth at the rate of light (186,000 miles per second). If a man were shot from this earth at twice that speed (372,000 miles per second), after two days' travel he would be looking back on events which had occurred two days before he left earth. In other words, he would see events which had occurred four days previous. Mr. Einstein might object to this interpretation of his comprehensive theory, but this explanation has been given many times in both lectures and, recently, in a movie of the Einstein theory.

Turbo-Electric vs. Geared Turbine

(2355) James S. Jackson of Kansas City, Kansas, writes:

Q. 1. Some of my friends and I recently had an argument about the advantages of turbo-electric drives and gear-reduction turbine drives. I claim that the turbo-electric drive is the most efficient. Can you settle this question?

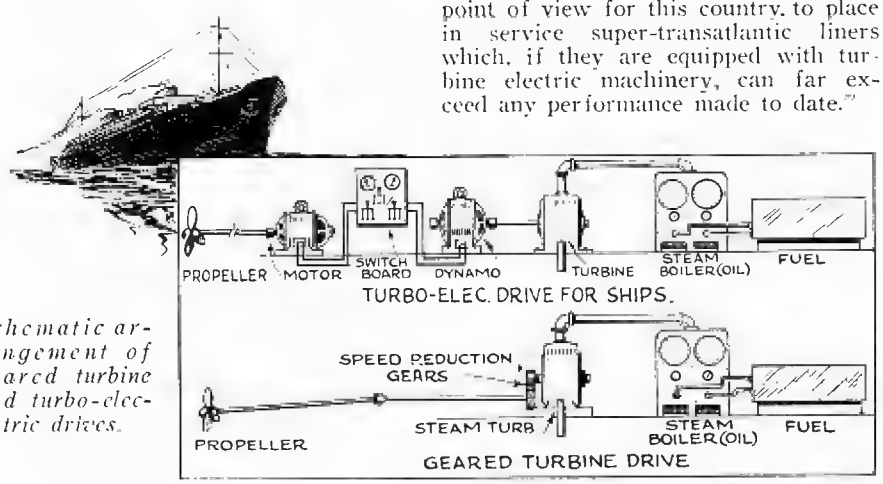
A. 1. In order to receive an expert opinion on this matter, we called on D. S. Niven of the Federal Marine Department of the General Electric Company. We received the following answer:

"An analysis of the two forms of drive, based upon statements of Dr. Bauer and his associates of the *Bremen*, shows that the total machinery weight with electric drive is practically the same; that it will take up no more room, and that the all-electric ship will be *from* 8 *per cent. to* 10 *per cent. more efficient*. The characteristics and performance of turbine-electric drive are even better for the higher powered vessels.

"Installations made with this typical form of American drive, as exemplified by the airplane carriers *Lexington* and *Saratoga* and the International Mercantile Marine vessels *California* and *Virginia*, prove conclusively that vibration and noise are very much less with any other form of drive and, from a passenger point of view, it is obvious that these two points are tremendously important.

"Maintenance of electric drive based on service results to date would be less than on geared turbines, particularly when it is considered that, in an installation of the capacity of the *Bremen, electric drive would have four high-speed turbines operating at a speed of 2,300 R.P.M. as against twelve ahead turbines and eight reversing turbines operating at a speed of 2,000 R.P.M.*

"It is practical from an engineering point of view for this country to place in service super-transatlantic liners which, if they are equipped with turbine electric machinery, can far exceed any performance made to date."



Schematic arrangement of geared turbine and turbo-electric drives.

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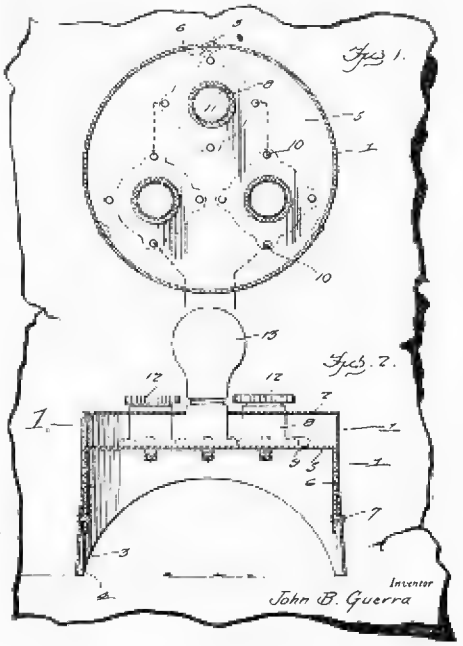
Selling a Patent

(1214) John B. Guerra, Chicago, Ill., submits a copy of patent No. 1,733,874, issued on October 29, 1929. He advises that the invention is patented in the United States and Canada, and he wants to know the best way to sell the patent on an outright basis.

A. Had you taken advantage of the Patent Advice columns of SCIENCE AND INVENTION Magazine before applying for a patent on the battery charger, we would have advised against such procedure.

We believe you will have very great difficulty in selling an idea of this nature. First, your device is nothing more than a lamp connected in series with the battery and can only be used on direct current circuits. Secondly, most of this country is electrically supplied with alternating current, and your battery charger cannot possibly be used. Thirdly, the day of batter charging is passé. All modern radio sets are operated directly from the line. Your device is not very practical for



storage battery charging because the lamp, even if of 100 watts capacity, will pass less than one ampere. This means that it will take about 150 hours to charge an ordinary 100 ampere hour storage battery.

There is no excuse for the two fuses in the circuit. Should the two leads to the battery become short-circuited, the only thing that can happen is for the lamp to burn brightly. The pair of fuses do not protect the battery against being overcharged, even though the patent specifications say so.

We would suggest that you go to your local library and look up Dun's or Bradstreet's and copy down the names of the manufacturers of battery chargers and then submit your plan to them. We further suggest that you take anything you can possibly get for this invention. It has but little value.

Remote Radio Control

(1215) Herman N. Kittredge, Rockland, Me., asks for advice about remote control for radio sets.

A. Many remote control systems have been designed and developed in which the dial is controlled by a motor. Whether or not you can get a patent on your device depends largely on the means of control. A motor connected with a drum dial through gears or otherwise is not necessarily a basis for a patent. Inasmuch as you have given us no information upon which we can base a comment, we regret that we cannot give further advice.

Lock for Doors and Windows

(1216) Jose Vigues, Nuevitas, Cuba, writes:

I am enclosing a drawing of my idea for a lock for doors and windows. I should like to sell this patent to a manufacturer.

A. We do not see that your lock for doors is in any way different from the very simple latch, yet it is just as costly to produce. Latches that are available on the market today at a cost of from 5 cents to 25 cents are even superior to your device because they do not require the fuss necessitated in your scheme to set the latch in position for fastening the door. We advise no action.

(1217) W. Thomas, Jerome, Arizona, asks a great many questions regarding the possibility of producing colored television images.

A. If we were able to answer all of the numerous questions which you have put to us, we would be inventing the idea of transmitting television images in color. There are several systems for doing that now. One of them employs the usual red, blue and yellow discs, driven synchronously with a similar set at the transmitting end. There are no gases with which tubes can be filled that will give you every color of the rainbow. If such a system were operative you could secure a very broad patent on your idea, but the United States Post Office requires that the patent be so worded that those gifted in the art can build and operate a similar device. The government protects you because you disclose your idea instead of keeping it a secret. An inoperative disclosure is worthless. Until you are in a position to demonstrate by a working model that your system will produce the results you expect of it, we are doubtful that there is any organization that would be interested in the purchase of an interest in the idea.

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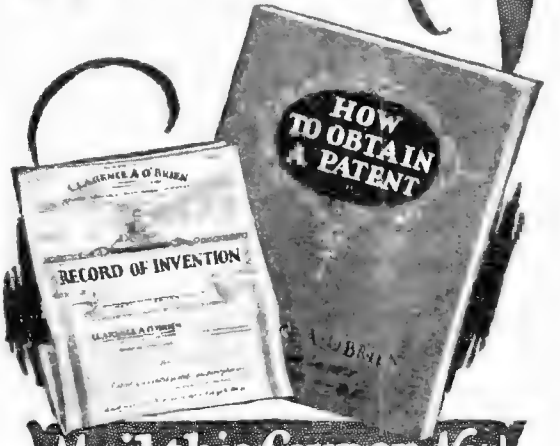

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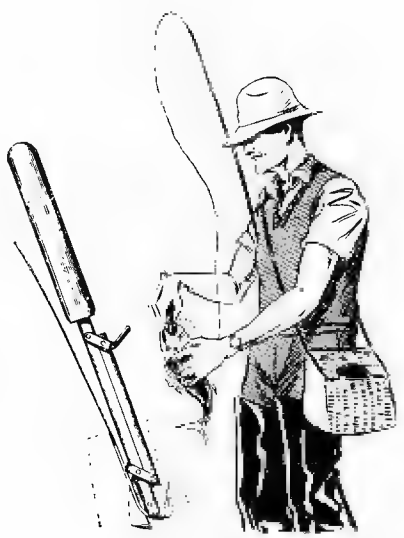
Check That Door!

No. 1,730,646, issued to Elizabeth Danner. Relates to a simple and inexpensive means of providing an efficient door-check. Consists of two hollow tubes, each open at one end and telescoped in sliding contact with each other. One tube is fastened to the door frame; the other to the door itself. Air resistance encountered in sliding provides means of checking door.

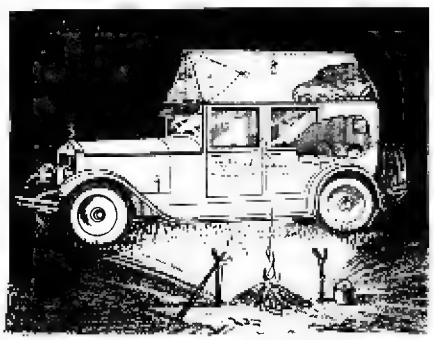
Another Ancient Prejudice Removed

No. 1,728,864, issued to Henry A. Kramer. Refers to a device for efficiently releasing a hook from fish. Comprises a shank having a means for engaging hook and controlled trigger means for releasing the hook and housing it after its release.



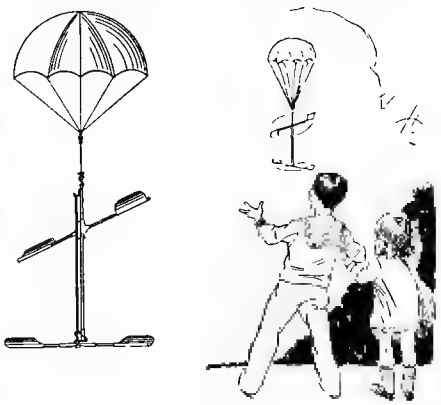
Comfort for the Open Road

No. 1,707,270, issued to Frederick B. Lichtenberg. Pertains to a tent or camp accessory designed especially for use in touring with a closed automobile of the sedan type. Consists of a canopy body, ridge pole means for supporting the canopy, a roller means about which the canopy body may roll and be held in complete tension at time of use. The tent may be folded down on top of the car while touring and not in use.



Junior Becomes Air-minded

No. 1,729,007, issued to Harry Tracy Nelson. Relates to new and useful improvements in helicopters or flying toys. Consists of a toy having a parachute connected to the lower end, the cords of the parachute are so attached to a sliding member so that on ascent the parachute is kept closed; on descent the sliding member permits the air to open the parachute.



Arctic Fever and Tropic Frostbite

By Carveth Wells

(*Continued from page* 13)

tropical fever in a terrific hailstorm.

At one spot on the equator, the car skidded along the ice and into the ditch that runs alongside that imaginary line. Eventually I reached the source of the River Nile at Rippon Falls, crossed Lake Victoria Nyanza and went on through Uganda, finally arriving at the foothills of the most important range of mountains in Africa, the Mountains of the Moon, seventeen thousand feet high and absolutely invisible. But in spite of the mist which for thousands of years has hid from the rest of the world these magnificent mountains, I plunged on and up, higher and higher, accompanied by fifty faithful Bakonju natives, who carried living fire in long cigar shaped bundles, and at meal times huddled round big bonfires to keep warm on the equator, and feasted on blackberries.

Day after day lightning flashed and thunder crashed while we struggled on in a blinding snowstorm. Trees disappeared while weeds became gigantic.

We crossed the Fallen Forest where a false step would have meant a fall into bottomless pits lined with great jagged spikes of almost petrified wood and on into the Enchanted Forest, where lobelias grew ten feet high, groundsel (canary food, see Encyclopedia Britannica) thirty feet high, and heather fifty feet high. This forest is indeed a paradise for Scotsmen and canaries!

We had no need for weather bureaus, as we controlled the weather by a flute played by a Bakonju witch doctor. If the sun went behind a cloud, our safari stopped while the witch doctor played upon his flute until it shone again!

At 14,000 feet, our porters were walking through equatorial snow, with their boots slung around their necks as ornaments.

Down dropped the temperature to twenty degrees, and on we climbed with sun helmets to protect our heads from the sun, and thick woolen stockings to ward off frostbite. What a life! Our worst camp was at Freshfield Col, where our tent was pitched in snow, under which was a layer of moss, and under that three feet of icy black mud, into which we continually plunged up to our waists; but to cheer us up, we were surrounded by acres of everlasting flowers—the kind that undertakers use.

When we entered the Belgian Congo, still at great altitude, we discovered parsley bushes nine feet high. If African parsley were used for garnishing beef steak, dishes would have to be fifteen feet in diameter with a nice roast ox in the middle.

Finally, after climbing through a forest of gigantic birdseed at fourteen thousand feet, we were overcome by a terrific blizzard, and for two days we huddled on a little ledge while the witch doctor tried to stop the storm with his flute.

It was a lovely August morning in Central Africa, with snow covering the tropical vegetation, when we crossed the huge Elena Glacier and reached the Scott Elliot Pass. On every side were Africa's eternal snows.

When Aristotle said that there were snow-capped mountains on the Equator in Central Africa, he certainly knew his oats. On the top of one was resting the calling card of the famous Duke of the Abruzzi, left there by him in 1906.

Africa was turned upside down. I had shaken the truth out of it at last!

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Get Out Your Smoked Glasses

By Donald H. Menzele, Ph.D.

(*Continued from page 29*)

During the progress of the eclipse the moon moves from M to M. As seen from anywhere along the curved line HABCK the bodies will be identical in size. Hence, along ADC, the actual surface of the earth, the eclipse will be total. Between CF and AG it will be annular.

This "freakishness," incidentally makes it rather difficult for the professional astronomer to observe the eclipse. Even at the most favorable position on the earth (D in the diagram) the excess of the apparent lunar diameter is so small that the line of totality is but three quarters of a mile wide and the duration about a second and a half, instead of 60 or 70 miles and several minutes, as in the average eclipse. The moon is noted for its erratic behavior. In spite of our best endeavors it refuses to follow exactly the orbit we calculate for it, which may prove embarrassing in the present instance. With so little leeway, we shall be agreeably surprised if we are fortunate enough to find ourselves inside the totality belt on April 28th.

The eclipse begins as an annular one in mid-Pacific, changes to total just off the coast of California, and back to annular a little south of Butte, Montana, as indicated by the bar across the line of central eclipse in figure 2. The approximate times of beginning and ending may be estimated from the curves drawn on the map. In the following table, the magnitude of the eclipse, i.e., the percentage of the sun's disk covered by the moon at maximum, is given for a few selected cities. By comparing your distance from the central path with that of the plans noted in the table you can figure out how the eclipse will look anywhere in the country.

	%
Albany, N. Y.	59
Ann Arbor, Mich.	62
Augustus, Me.	64
Austin, Tex.	41
Berkeley, Calif.	99
Boise City, Idaho	99
Chicago, Ill.	59
Denver, Colo.	76
Flagstaff, Ariz.	76
Honolulu, Hawaii	74
Juneau, Alaska	52
Louisville, Ky.	51
Los Angeles, Calif.	85
New Orleans, La.	30
New York City, N. Y.	54
Omaha, Nebr.	69
Salt Lake City, U.	88
Seattle, Wash.	83
St. Louis, Mo.	56
Tallahassee, Fla.	26
Washington, D. C.	49

"Both Ends of the String"

(*Continued from page 29*)

by the book which he wrote "Progress in Flying Machines," telling of his experiments made with gliders launched from the sand dunes along the south shore of Lake Michigan.

Mr. Braine, a very enthusiastic member of our party, Louis R. Adams, president of the aeronautical society, Carl Dieustbach, a noted German aviation authority, and myself took the machine, which we all helped to build and repair, down to my brother-in-law's estate at Locust Valley, Long Island, not far from today's Roosevelt Field. From one of the ridges nearby we made gliding flights, taking turns in sailing off the hilltop where the wind was strong and keeping up as long as we could, balancing by shifting our weight from one side to another or forward or back on the padded side bars which went under our arms.

We made glides of about 100 yards and found it great sport, though the neighbors predicted that we would break our necks in the "consarned contraption."

You could count on the fingers of your hands the men who had made successful gliding flights in 1908; while today an adding machine would have to run at full speed to keep track of the numbers who daily are experiencing the sensation of flight.

Says Mr. Lynch—

Today's motorless plane embodies a most effective means of training the power plane pilot of tomorrow. And in the future the glider stands forth as an ultimately common means of individual aerial transport.

The glider pilot learns to fly by *feel*. In the primary glider there is no structural or other feature between the pilot and the horizon which can be used to determine whether the ship is gliding normally, stalling, or diving. There are no instruments to help the pilot regulate his flight. And later, when the glider-trained pilot flies a power plane, he will fly by instinct, in contrast to the graduate of a regular flying course, who flies by art. Naturally, the glider-trained man will act to meet an emergency while the more conscious flier is wasting precious seconds figuring what to do.

Training in a glider is a safe method. Out of a thousand flights by novices and near-novices at a Cape Cod school last summer, not one brought forth an accident which resulted in more than a scratch or bruise.

The hydroglider, towed by a motorboat, promises further interesting developments in glider technique. Glider economy in any case is outstanding, since a glider can be built at a tithe of the cost of a power ship.

Gliders can now be bought for from $200 to $400 and for $150, a primary course, including board and lodging for training period, can be had. A glider can be built at home from blueprints for fifty dollars.

Today glider clubs are forming throughout the United States, and seventeen organizations are already building gliders for the market. At the rate the sport is developing, we shall soon have our full quota of pilots for power plane work, and they will be pilots of the instinctive type—the best.

Among the Features of June SCIENCE AND INVENTION will be "The City of Tomorrow—Today," by Don Bennett. . . . A story of a New Kind of Town, Built for the Motor Age, with complete separation of pedestrian and Automotive Traffic.

Wings for Us All!

By Karl S. Betts

(*Continued from page* 14)

of San Diego now boasts several first-class soaring pilots within its membership, including Colonel and Mrs. Charles A. Lindbergh. Colonel Lindbergh qualified for his first-class license with a fine thirty-minute flight at Point Loma, and Mrs. Lindbergh secured her three star insignia the following day with a six-minute flight.

William B. Stout, Lieutenant Ralph Barnaby, Dr. Wolfgang Klemperer of the Goodyear-Zeppelin Corporation, Eddie Stinson, Captain Frank Hawks and scores of other well known flyers have taken up gliding enthusiastically and have qualified for licenses as glider pilots. William Hawley Bowlus, of San Diego, has established several American records within the past few weeks, and his last flight of six hours and twenty-five minutes stands at present as the official American duration record.

Several glider meets are scheduled for this year by the national association, and official sanction has been granted the Western Glider Meet to be held at San Diego, California, on April 10, 11, 12, and 13. The New York Glider Carnival, which will be managed by the writer, will be staged at the Queensboro Golf and Country Club on Long Island, on April 26 and 27. Several feature demonstrations are planned for this meet, including another exhibition of cutting loose a glider from the dirigible Los Angeles, with Lieutenant Ralph Barnaby, United States Navy, at the controls. Edward P. Warner, Editor of *Aviation Magazine* and formerly Assistant Secretary of Aeronautics of the Navy Department, has been named Chairman of the carnival committee and has organized a strong group of New York aviation leaders to supervise it.

Another preliminary to the National Gliding and Soaring Contest to be held in September will be the Frank Hawks Trans-continental Glider Flight, which, it is announced, will be staged in the near future. This flight will take Captain Hawks to San Diego and back in a glider towed by an airplane. The date of this flight and the route to be followed have not yet been announced, but the arrival in San Diego and in New York is expected to coincide with the glider meets arranged for in both places.

$5,000 FOR PERPETUAL MOTION

The editors have received thousands of different designs of perpetual motion devices, and have received hundreds of circular letters soliciting finances for the building of perpetual motion machines.

The editors know that if they receive these letters, there are thousands of others in this country who get similar letters and who fall for the claims made in the numerous prospectuses giving the earning capacities of the various machines.

Most of the shares of stock for these perpetual motion machines are being sold at a rate of $1.00 per share, although some inventors are trying to sell shares of stock at $100.00 per share.

Therefore, the editors of this publication say, "Just come in and show us—merely SHOW us—a working model of a perpetual motion machine and we will give you $5,000.00. But the machine must not be made to operate by tides, winds, waterpower natural evaporation or humidity. It must be perpetual motion."

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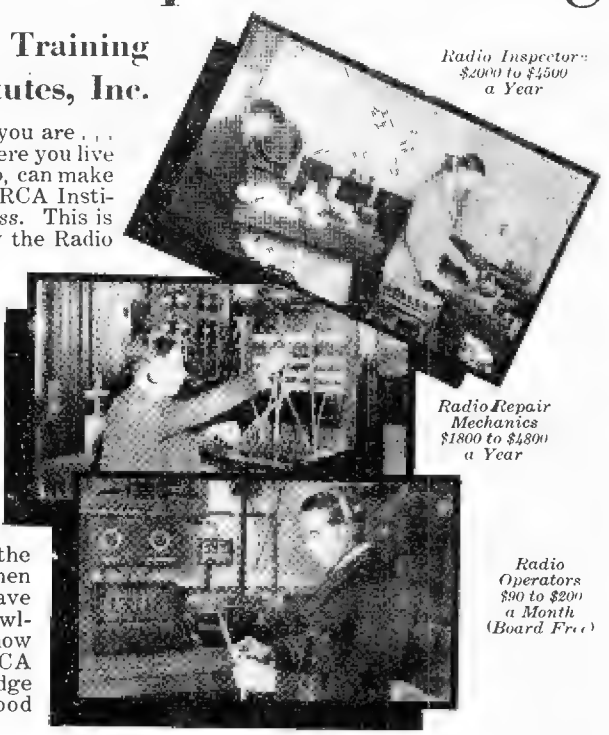

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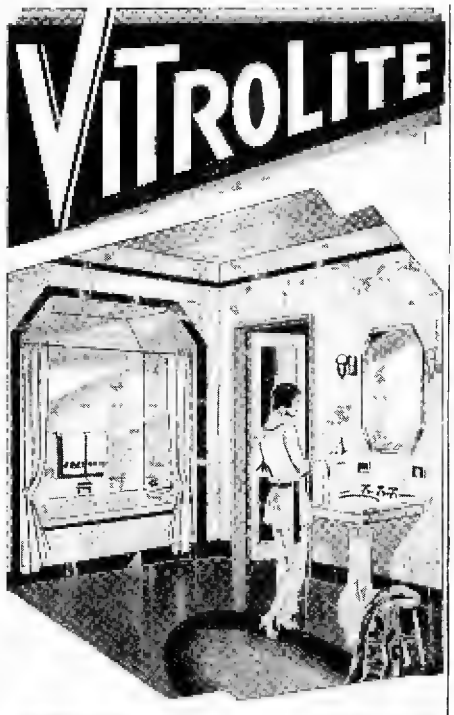

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Speeding the World's Words

By Mary Jacobs

(*Continued from page* 11)

distributing clerk's chart of 500 lights shows the wire is in use and in which of the five groups of operators it is being used.

"As messages come in for subscribers to direct lines in the unit, the process is reversed. The distributing clerk sorts these messages into the proper slots. Girls note by the chart whether the wire is busy. If it is she takes the message to the machine working that wire. If it is not she notes by the room chart lights the location of idle operators and takes the message to the nearest one for transmission.

"In developing the 100-wire unit we first tried a modified telephone switchboard. This gave better service than individual lines, but was not good enough. So we worked out tentative designs for handling 1,000 lines at once. We finally agreed that a 100-wire concentrator would suit present needs best, so we perfected such a machine."

It wasn't easy. Provision had to be made for but one conductor per line, so that the terminals of each line would take up a small space. (They occupy only 1/16 of a square inch). The depth of panels containing these terminals was brought down to a few inches as against the telephone measurement of about a foot. The engineers had to work out a system whereby an operator at any position could get a busy signal—quite essential in dealing with 100 lines combined! The vacuum-tube rectifier which permits the current to go one way and not the other was employed here, together with suitable relays and lamps.

According to Mr. Drake, this concentrator is a development in telegraphy of greater importance than can be easily realized by the man who does not come in personal contact with it.

As to the future developments—"I'm afraid we engineers have our noses too deeply buried in our work to make good prophets," Mr. Drake said with a smile. "We're too much interested in meeting immediate problems to devote much time to the distant future. There is the possibility that telegraphy will be used for flashing whole page, facsimile reproductions of newspapers from city to city, scanned with an electric eye. So far, however, the means available for such facsimile transmission cannot compete commercially with the printing telegraph machines. With the latter, some experiments have been made in transmitting a large amount of news matter by telegraph on perforated tape, fed into a monotype machine.

"Telegraphic photographs are now delivered. Already we have had one of King George opening the Naval Conference in London sent over Western Union cables to newspapers in this country. Any symbols, words or characters which may be photographed may be sent by wire. We transmit messages in Chinese from coast to coast.

"There is a possibility that some day a regular telegraph receiver may be in each home. Or perhaps each office will be equipped with pneumatic tubes for dropping messages. We can do this now, but few homes have enough business to justify it. Perhaps some day a pocket telegraph set will be invented with which individuals may receive messages at many given points."

But all this is in the future. Meanwhile Mr. Drake continues his research work. His province includes the testing equipment on switchboards to determine the conditions of wires. For years he has been working on the protection of wires between cities against lightning and other forms of interference. This guards the accuracy of transmission and protects employees from injury. He has also done considerable work on telegraph repeaters and the systems used for the transmission of time and messenger call signals.

The distributing clerk is taking a message for transmission from her file, working with the 100-wire concentration unit.

Los Angeles Says Stop

By Arthur G. Arnoll

(*Continued from page* 16)

and their remedy from the viewpoint of the child pedestrian are regularly distributed and displayed. Safety patrols, chosen from among the children themselves, keep a lookout for violations, and there are suitable demerits for flagrant cases. Hitch-hiking and begging for rides have been almost eliminated by consistent appeals to the child's pride, and the general success of the campaign may be seen in the fact that accidents to school children in the city show a reduction of eleven percent against the average for the rest of the country.

As a means of facilitating the flow of traffic through the busiest streets, Los Angeles officials favor a wide application of the over-and-under type of intersection. It is hoped that this form can be introduced at points like the Wilshire-Western Avenue intersection, where 41,000 motor cars pass each eight-hour day.

An article describing how CLEVELAND is treating its traffic prblems will appear in SCIENCE AND INVENTION for June.

Eyes Across the Sea

By William Watts Chaplin

(*Continued from page* 17)

cellar door slammed. He had worked for two months all toward this one moment and he was anxious to see the results. But as his feet began groping down the dark stairs the lady of light, as though she heard him coming and did not wish her audience increased, went all to pieces.

An ear unhinged and floated away. The mouth opened so wide that there was nothing of the face left but an irregular outline and that broke suddenly into a thousand pieces to scatter like snowflakes in a storm. When Hart got to a place where he could see there was nothing left to be seen.

"Static," the mechanic said with disgust. "I'll try to get her back." But Mrs. James Howe was staying in London for the rest of that night, and no repetition of the experiment was achieved. Shortly afterward Hutchinson and his mechanic took their televisor back to England, incidentally giving a demonstration on the way of television from London to a liner in mid-ocean, so the man who had given his time and skill and equipment and worked as hard as anyone else never did actually see the transmitted vision.

Before he left I asked Capt. Hutchinson about the televisor, which during his stay in the country he had carefully guarded from inspection, carrying it each night to his hotel room in New York. What special development was there, I asked, in this set over any of the other television machines.

"It is merely a simple set," he replied, "using the same principles as all the others, except for one thing. There is a photo-electric cell, amplifiers, and a scanning disc with spiralled perforations. At the transmitting end an 'electric eye' views the subject through these perforations and the degree of light on each small segment of the subject is translated into electric energy. This is transmitted and received just as sound is, and then turned back into light, thus forming an image. The only secret we have is our means for synchronizing the discs at the transmitting and receiving terminals and that cannot be divulged."

By the time I got back to the office in New York from Hartsdale about an hour after the experiment, the story I had telephoned in from the Hart home had already been cabled to Europe and a story by Mrs. Howe, telling her feelings at being the first woman ever to have her face lifted across the Atlantic, had already been received.

I got a good laugh out of her reactions, because she said that when she was told to place herself before the television she went first to a mirror and arranged her hair. Yet all the image had for hair was a half circle of light.

The newspapers gave the story of the first transatlantic television a big play and once more a new phase of science was dramatized so that the man in the street could visualize its eventual application to the purposes of everyday life.

WE OFFER $400 IN AWARDS FOR BASEMENT PLAN

THE SCIENCE AND INVENTION Basement Utilization Contest is in full swing, but there is still time to work out and send in the plan that may get you a share in the $400 cash awards.

The idea is to present a practical plan for converting waste basement space into attractive, comfortable rooms for work, relaxation, or recreation. The basement may be yours, someone else's, or nobody's—it may be real imaginary, or proposed.

The contest is open to all readers. You can send in as many plans as you please. Each plan should be made the subject of a separate letter. No letter should exceed 1,000 words.

A drawing will help the jury to understand your idea. Make a rough sketch showing the approximate dimensions of the basement, location of doors and other openings, permanent equipment, etc. For a planned remodeling, send two drawings, one showing the basement as is, the other showing the changes you propose. In this case, divide your letter into three parts. In the first describe the existing basement; in the second describe the changes you propose; in the third describe the materials and methods you propose for its transformation; wall, floor and ceiling treatments; kind and purpose of partitions, if any; provisions for damp-proofing, heating, ventilation, lighting, etc.

For a basement already remodeled, limit your letter to the basement as is, describing the means and methods used to make it comfortable and attractive. For a proposed new basement, describe the materials and methods you intend using to make it dry, comfortable, and attractive, also the equipment you mean to install.

Interesting hints on materials, methods, and equipment are available in the booklets listed on page 84 of the present issue. Order by number. For other information see S. Gordon Taylor's article on basement conversion in the March number of SCIENCE AND INVENTION, also the article on damp-proofing your cellar, in the same issue, by J. W. Von Stein.

Typewrite your letter if possible. However, this is not essential. Use only one side of each sheet and place your name and address on each.

The jury will select as the winning plans those which are best from the standpoint of comfort, attractiveness, and ingenuity of arrangement, allotting them prizes in the order of their merit. But to be considered on these grounds, a plan must be capable of being worked out in practice.

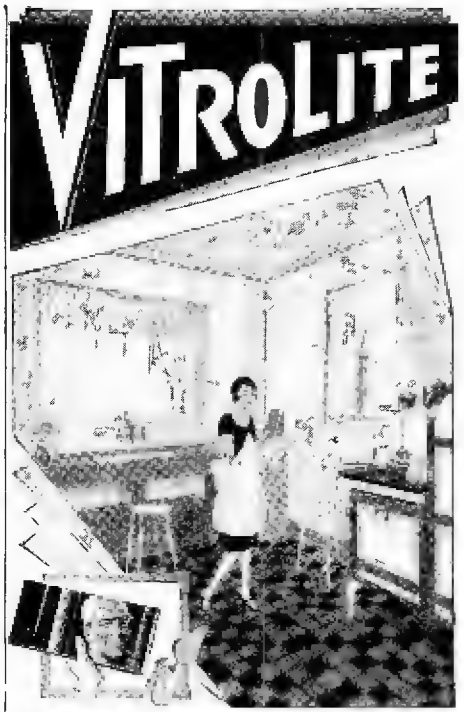
The decision of the jury will be final. The full amount of the prize involved will be awarded each tying contestant in case of a tie. Not more than one prize will be given any one contestant.

The Contest opened February 10 and will close at midnight on May 31. All entries, to be eligible, must be received by SCIENCE AND INVENTION, 381 4th Avenue, New York, N. Y., before that time.

Prize winners will be notified approximately two weeks after the closing date. Their names will be announced also in the September issue of this magazine.

Duplicate copies of plans should be held by readers desiring them.

SCIENCE AND INVENTION reserves the privilege of publishing any idea received. Entries thus published will be paid for on publication at the rate of five dollars each, if they have been awarded no regular prizes.



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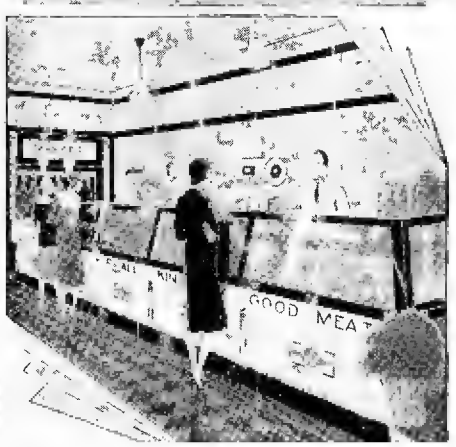

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Vitrolite is enthusiastically endorsed by architects, builders, and interior decorators. It is easily installed and can be plain or especially designed or etched to give either traditional or contemporary effects. A Vitrolite installation is economical and the trade-mark on each slab is your assurance of quality.

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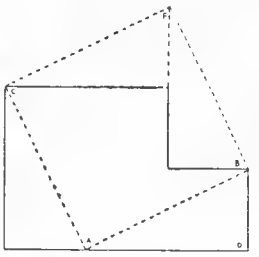
Answers and Prize Awards in February Puzzle Contest

By Sam Loyd



The diagram for the solution to "The Accommodating Metal Dealer" problem illustrates how the metal should be cut to form a square

Solution to "Jack London's Puzzling Ride"

JACK LONDON went a distance of 133⅓ miles from Skagway to his camp. He traveled 33⅓ miles the first day. Then he went the remainder of the journey at three-fifths speed, 20 miles per day, which brought him in two days late. Had the two dogs remained with him for a further 50 miles, he would have reached his goal one day sooner.

Since it was stated that a further distance of 50 miles at full speed would save him one day, it follows that a further distance of 100 miles would save him the two lost days. Therefore, the remaining distance after his first day's travel must have been 100 miles.

In the same time that he went 100 miles at three-fifths speed, he would go 166⅔ miles at full speed, which establishes his schedule speed as 33⅓ miles per day.

Solution to "The Accommodating Metal Dealer"

THE diagram shows how the piece of copper is reformed into a square by rearrangement of its three parts. We cut from A to B to produce a triangle whose base and elevation are similar to the sides of the two squares. The line of the hypothenuse, therefore, shows the dimension of the large square, which will equal the two. Then from A to C we clip off another triangle of the same dimensions. Thus the two cuts have produced four edges of the required length for the sides of the prospective square, and all that remains is to place them in position to produce the square A, B, E, C.

The perimeter of the figure is equal to ten times the side of the small square. Its area is five times the area of the small square.

It being told that the perimetrical length, figured at 72 cents per foot, would amount to the same as the area figured at 60 cents per square foot, we arrange the equation: $5X^2=1^1/_5$ (10X), which solved, gives the value of X as 2⅖: 28⅘ square feet at 60 cents amount to $17.28. Likewise, 24 running feet, at 72 cents, amount to $17.28.

Prize Winners in February Contest

First Prize of $10 is awarded to Gerald G. Decker, Chamber of Commerce, Mission, Texas.

Second Prize of $5 is awarded to E. A. Cuellar, 204 Bay State Road, Boston, Mass.

The ten prizes of $1 each are awarded to the following:

Thomas Petre, c/o Arthur Judson Concert Management, Steinway Hall, West 57th Street, New York City.

William Zborowski, 6251 Bereniece Avenue, Chicago, Ill.

C. R. Wylie, Jr., 77 Parkhurst Place, West, Detroit, Mich.

J. Dentraygues, 319 Commercial Street, Los Angeles, Calif.

H. V. Nyland, 402 La Porte Avenue, Whiting, Ind.

Helen W. Shuman, 353 Harrison Street, Portland, Oregon.

Donald Culver, Laurel, Del.

E. J. Kinleyside, R. D. 3, Jefferson, Ohio.

Cecelio Delgado, Department of the Interior, San Juan, Porto Rico.

Harry R. Reckwerd, 3503 Carlisle Avenue, Covington, Ky.

Cook While You Play

By Mrs. Christine Frederick

(*Continued from page* 46)

bottom to help hold the heat. The result is that your food goes on cooking slowly for hours *without any fuel cost.* A roast of beef, for instance, will require only 25 percent of the usual time in the oven—it will cook the other 75 percent of the time without any fire.

A bright gas stove manufacturer supplies the insulated cover for the pot right on the stove; you simply turn off the gas at the right point and pull down the cover. It is splendid gas economy.

One of the newest things is a "vapo-seal cooker" which gives the effects of the waterless cooker without the heavy insulated base, using simply super-thick aluminum. Like the waterless cooker, it makes possible cooking four foods at one time over the same burner; it is of 12-quart capacity, and made of rustproof chromium alloy, with thermoplax trimmings.

Another new wrinkle is a "thermostove cooker." The food is placed in the aluminum utensil and set in the cooking well, which is sealed with a steamtight plunger. When the food reaches the boiling point and live steam is blown out through the aluminum vent, a strip of the thermostat metal curls and trips a trigger which turns off the current. Heat stored in the heavy porcelain heating element in the bottom of the well finishes the cooking.

Courtesy The Durham Mfg. Co.

The deep-well fireless cooker provides ample room for preparing your entire meal simultaneously.

A portable oven, lined with aluminum and heavily insulated, is available for use on the top plate of the cooker.

Feed Your Plants With Chemicals

By Raymond B. Wailes

(*Continued from page* 24)

three weeks. Iron, or copper sulphate can be applied to rid lawns of weeds, especially dandelions. One pound dissolved in a gallon of water treats 400 square feet of lawn.

To rid the lawn of crab grass apply about ten drops of strong sulphuric acid to the crown of the plant in between the shoots. In one minute the effects of this corrosive acid will be seen. Charring occurs, due to the formation of uncombined carbon, and is followed by the utter destruction of the root system of the plant.

One drawback to the sulphuric acid method is that the lawn must be made absolutely impassable to any living thing for several days afterward. By the end of this time the acid will have abstracted enough water from the air to make its way into the top soil by dilution. Rains or the garden hose will drive the remaining acid into the soil, so that the surrounding grasses will not be affected. Of course one should be careful not to spill the acid on the clothes or hands. Rubber gloves and rubber overshoes will outfit one for this "acid cure of crab grass." The brown and unsightly clumps of crab grass can be pulled up about a week later or allowed to remain as humus. The writer has used this acid method with very good results. Carbolic or muriatic acid can also be used, but for absolute destruction strong sulphuric acid is best. All three are virulent poisons.

Weeds on tennis courts or similar places can be removed with dry calcium chloride. This substance rapidly absorbs water from the air and the resulting solution destroys vegetable growth. Common salt will do the same, but calcium chloride will be found to be far better. The calcium chloride should be kept in an airtight container or it will "turn to water," or go into solution by taking the moisture from the air.

The basis for some of the artificial manures which are on the market is: ammonium sulphate, sixty pounds; superphosphate, thirty pounds; potassium chloride twenty-five pounds, and ground limestone, fifty pounds. The whole is to be applied to one ton of dry straw, grass or other similar material. Certain microorganisms present in the strawy material thrive upon the straw when the mineral conditions are right. The added chemicals supply this condition, with the result that the bacteria go to work making artificial manure for the flower-lover.

It is well known that blue hydrangeas are produced on acid soils. Such soils can be made by adding tannic acid, alum, ammonium sulphate, or even soot to the soil about the base of the plant. A tablespoonful of the chemicals dissolved in a gallon of water and applied every week or so will maintain the soil in an acid condition.

The plant lover can also use chemicals to cause early germination of certain seeds. Such hard seeds as *musa eusete*, or Abyssinian banana, grown for their ornamental foliage, will sometimes respond to soaking in a glass of water containing three or four drops of saturated copper sulphate solution. After being soaked in solutions of magnesium chloride, manganese sulphate and sodium nitrate, the seeds of peppers, spinach and parsnips were found to give a higher percentage of germination than untreated seeds.

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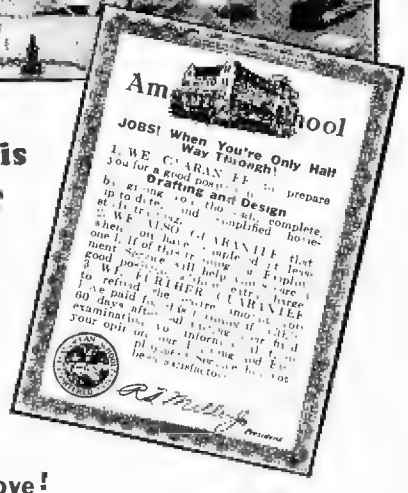

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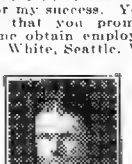

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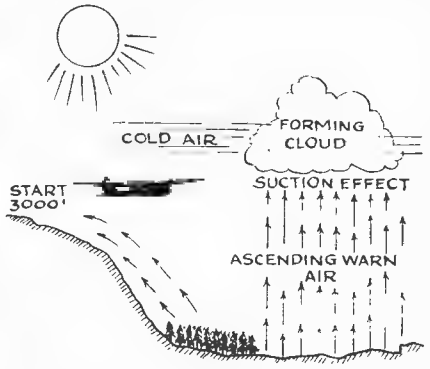
Riding the Thunder-clouds

By Martin H. Schempp

(*Continued from page* 15)

and horizontal base, that appear suddenly on a warm summer day. Do you know how they are formed? The atmosphere is heated, not by the sun direct, but from the heat radiated by the earth. And even on a hot day the air above a woodlot will remain much cooler than that above an open field. So the air above the field will ascend and expand until its moisture content reaches its dewpoint and turns to water vapor, thus forming a so-called cumulus cloud.

Whenever we see a cumulus cloud, we know it marks the top of a thermal vertical air-current. Therefore one has only to reach a point a few feet below a cloud of this type to take advantage of a strong upward wind on which to soar one's glider toward a record!



The process by which a cumulus cloud is formed.

Three thousand feet up on the slopes of the Rhoen Mountains, the glider pilots can see cumulous clouds forming above the plain below. They take off and soar aloft on the mountain upwinds. They wait their chance. Then, when they sight a cumulus cloud within their gliding range, they desert the mountain current, steer across the intervening space, and "hang their ship upon a cloud!" And there they stay until another comes within range and furnishes them with a further sustaining force. Or they may glide on to another mountain upwind, which in turn will bring them within range of a new cumulus cloud. . . . A fine and thrilling method of "hitch-riding!" And the art of the soaring pilot is the art of knowing the moment when he can desert one cloud-current or mountain upwind for another. In 1927, Bachem and Dittmar thus made their record flights.

This is not quite "riding the thunder-clouds." But do not think that our glider pilots are backward about following Kegel's involuntary example of this art. On the contrary, our master soaring men wait for nothing more anxiously than for a thunderstorm to give them a lift. Still it takes nerve and ability to negotiate a storm of this kind, as the report of Robert Kronfeld on his world record flight (altitude, 6000 feet; distance 95 miles) will show.

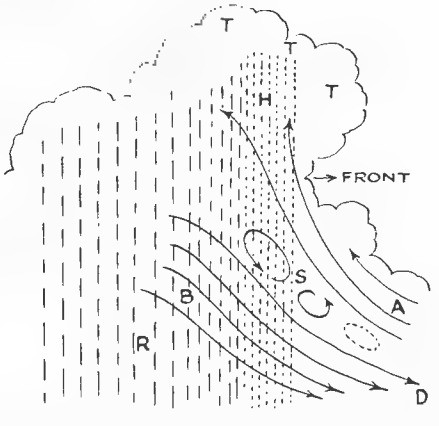
"It was on a hot afternoon during this year's soaring meet," says the report, "in the Rhoen. When I reached the starting point, Pilot Wolf Hirth already was soaring with clouds 3000 feet above. Just then there was no wind whatever. It began to sprinkle and the spectators dispersed. Suddenly the anemometer's hand went to 12, to 18, to 21, to 24 feet a second—and kept going higher. I gave the command. The crew stretched the shock cord, and I was up. . . .

"I have no time to stay on the slope. The rain pours over the fuselage and wings. There is thunder everywhere. The race starts. Shall I be able to keep ahead of the storm. . . . The altimeter climbs without cessation. That may save me. The higher I get the more quiet it seems. On both sides I can see over the storm-clouds. Small white clouds rise like pigeons below me. Wrecked clouds whirl around my ship. They pile up denser and denser. I am trying hard to keep a course straight east. It seems impossible. The compass goes in a circle. My speedometer jerks up to 70 miles an hour, and by pulling the machine I try to lower the speed.

"Suddenly it grows very quiet. My speedometer goes to zero! I try to bring the ship to normal speed. I have the feeling of tumbling forward, head over heels. My vision becomes as in a fever dream, first faint, then distinct. . . . Fields and gardens are circling around me. It is light. I restore again the balance of the machine. There is a town below, and I keep on. Again the compass indicates a course to the east. My hair and shirt are drying, emphasizing the coolness of a 6000-foot altitude.

"Time passes. It is growing dark. There are wide, empty fields below. I glide down to a field suitable for landing, and after a few curves the ship slips through the grass. . . ."

That is what it means to ride a thunder-storm.



Cross-section of a thunder-storm—A, ascending air B, descending air; S, roll scud; D, wind gust; H, hail; T, thunderheads; R, rain.

Watch for "How to Make a Glider Release Trap," by Martin H. Schempp, in SCIENCE AND INVENTION for June.

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How many more years must this prize be offered? Spiritualists, please answer!

Air Lanes of Dots and Dashes

By George R. Brown

(*Continued from page 23*)

against the weather and fire hazards. This dynamotor derives its power from the regular 12 volt 65-ampere-hour storage battery, thus rendering it suitable for full emergency operation. A small 5-ampere 15-volt wind-driven generator is used to charge the battery continually while in flight.

The receiver uses a UX *222* aperiodic coupling tube, one turned circuit, a UX 112A regenerative detector, a high gain space charge UX *222* audio amplifier, and a UX 112A output tube. Plug-in coils are provided to cover 17, 32, 54, and 590 to 900 meters. The complete receiver weighs 10½ pounds, while the total weight of receiver and transmitter and dynamotor is 42½ pounds.

All important adjustments of performance and wavelength are made at the airport before the plane leaves the ground. With the aid of a test set designed especially for the purpose this operation is reduced to simple routine, and expensive test flights are thus eliminated. This system has the important advantage that the adjustment of the apparatus can be properly carried out by a competent and qualified service man. Thus the number of cases of failure on the part of the apparatus is considerable reduced. This becomes even more important when it is considered that during nine months of use the average two-way communication was 98.4 percent.

The problems involved in creating this apparatus were many. Such factors as size, economy of weight, bad conditions in airplanes due to noise and vibration, and the fact that in many cases the apparatus had to be installed in aircraft where no provision had been made for its proper arrangement had to be considered.

These difficulties were all overcome in due time. The result was a complete apparatus weighing but 42 pounds, completely installed and mounted on spring cushions to offset noise and vibration.

This apparatus had been extremely successful not only in the transportation system of the Pan-American Airways, but in many other airplane ventures. After completing his airplane flight through the Mayan jungles last year, Colonel Lindbergh wired the Pan-American engineers, "Radio communication has been one hundred percent efficient on entire flight—Lindbergh." It has recently been used by the Army Air Service at Wright Field. Here the radio apparatus was used as a means of instruction for student pilots. Again, the Marine Corps used it on their flight from Philadelphia to Nicaragua during the recent uprisings in that stormy country. In addition it has been used by the Arctic Patrol of the First Pursuit Group, Army Air Service, in its flight from Selfridge Field to Seattle, Washington.

William Watts Chaplin contributes another Great Close-Up of Modern Science—"The Sky Talkers"—to SCIENCE AND INVENTION for June.

Why Are We Nervous?

***By* A. Griffiths, M.D.**

The principal causes of nervousness can be explained in simple language. They are two: First, Nerve Weakness; Secondly, Derangement of the Nerves.

Nerve Derangement can be explained crudely as follows: Our nervous system is somewhat like a great telephone system, in that it transmits messages from one part of the body to the other; the brain being the central office. It is the character of the messages sent *through* the nerves that cause nervousness; messages that flash from the mind to the vital organs and muscles, and back again to the mind. Therefore, anything that disturbs or irritates the mind causes irritating messages to be sent through the nerves to the entire body, especially to the vital organs. This explains why worry, anxiety, fear, anger, grief, jealousy and kindred mental turmoil cause nervous indigestion, heart palpitation, high or low blood pressure, constipation, etc. Worst of all, this cycle of mental and physical upheaval may lead to insanity or suicide. Our insane asylums are crowded to the doors because of conditions that owe their origin to nothing more than simple nervousness. Thousands of sufferers commit suicide every year, and millions of people are unhappy because of their nerves, that is, because of the irritating messages that are transmitted through the nerves. Nerve weakness is entirely different from nerve derangement. It is a condition known as "Neurasthenia," meaning, Nerve Exhaustion. As the noted scientist, Wm. Osler, described it, our nervous system stores a mysterious something, which for the want of a better term, we must call "Nerve Force." This stored force represents our nerve capital. If we squander this force through excesses and undue strains, we naturally become Nerve Bankrupt, that is, the nerves become exhausted, and we have what is known as neurasthenia. Or, as another great scientist very vividly expresses it, "Think of a cut in your arm from which your life's blood is trickling away. Yet millions of people live on from day to day, permitting a loss of vitality which is even far more precious than their blood; namely, they ruthlessly waste their Nerve Force."

Nervousness, then, is due to two major causes; (a) Crazy Messages transmitted through the nerves, which disturb the mind and vital organs; (b) Nerve Exhaustion, due to abuse of the nerves and ruthless waste of Nerve Force. Paul von Boeckmann, who during the last thirty years has carefully studied the mental and physical characteristics in over 400,000 people with high-strung nerves, has proved by actual statistics that at least 90 per cent. of these people are nervous or suffer in some way through their nerves, because of the two nerve abuses mentioned. We see evidence of nervousness about us everywhere, among our friends, in trains, street cars, yes, right in our own homes, and it requires no expert in nerves to see plainly the misery and unhappiness that come from nervousness. He says, further, "It is difficult to imagine anything but perfect health if the nerves are in order." That is, with calm nerves, and abundant Nerve Force, the stomach can digest any kind of food, for digestion depends directly upon the "stomach nerves." And so, too, would the body be free from colds, for a cold can only be contracted during low nerve pressure, i. e., lowered disease resistance. The same is true with constipation, and scores of other complaints with which the average person is afflicted. Beard, the great authority on the Nerves, who originated the term, "Neurasthenia," agrees with him in this statement almost word for word.

Nervousness, and the train of evils that result therefrom, may be said to develop in three stages, which may vary greatly, according to individual characteristics; namely,

First Stage: Nervousness, restlessness, sleeplessness, lack of energy, poor circulation, and other minor symptoms of low vitality.

Second Stage: Nervous indigestion, belching, sour stomach, gas in the bowels, constipation, shallow breathing, decline in power of reproductive functions, high or low blood pressure, hot or cold flashes, heart palpitation, mental uneasiness, irritability, undue worry, despondency, self-consciousness, etc.

Third Stage: As nerve weakness advances, the symptoms mentioned before become more severe. It is then the more severe mental symptoms appear; namely, fears, melancholia, dizziness, loss of memory, hallucinations, suicidal thoughts, and, in many cases, INSANITY.

If only a few of the symptoms mentioned here apply to you, especially those indicating mental uneasiness, you may be certain that your nerves are weak and deranged. Fight this weakness as you would fight for your life. *Conquer it*, or it will *conquer you*. To correct nervousness demands, first of all, that the sufferer understand his own condition—the "Why and How" his nerves act as they do. The cause of the trouble must be understood to be corrected. No medicine ever concocted can correct nervousness. There are drugs that deaden the nerves and make them calm. These are very dangerous. There are other drugs that stimulate exhausted nerves. These act similarly to dragging a tired horse behind an automobile to give him "pep." All "nerve drugs" are dangerous and unnatural.

Many books have been written, intended as a guide for keeping up the nervous forces and calming the nerves. In nearly every public library one or more practical treatises on this subject are on file. The most concise and practical of all these books the writer has so far come across is one by Paul von Boeckmann entitled, "Strengthening Your Nerves," which may be found in many public libraries and at the National Medical Library at Washington, D. C. I advise earnestly that the sensible advice given in this practical little book be given careful consideration by any one whose nerves show signs of irritability, instability and exhaustion. The concise, understandable and non-technical information contained in this book is by far the most useful of any I have read. In these days of High Pressure my advice is: Guard Your Nerves.

NOTE:—von Boeckmann is a high authority on the subject of nerve culture, and with the advice given in his book, any one can in a short time improve his control of the nerves 100 per cent. Far over a million copies of this excellent work have been sold during the last twenty years. Every reader should avail himself of this offer, for as stated, we are all nervous, more or less.

The book, "Strengthen Your Nerves," by Paul von Boeckmann, may be obtained direct by addressing him, Studio 1800, Cellini Building, 48 West 48th Street, New York City. Enclose 25c in coin or small denomination stamps. It will be forwarded promptly in plain wrapper, postpaid.—*Advt.*

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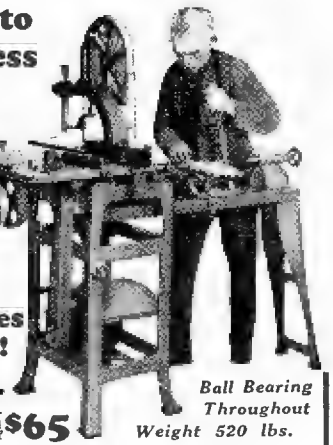

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Diesel Car Makes Debut

By A. E. LeBlanc

(*Continued from page* 25)

Company of Columbus, Indiana, normally used for marine and industrial work. It was installed with practically no change in the original equipment of the motor car. The electric starter proved able to perform its function as readily for the Diesel engine as for the gasoline power-plant. A small push-and-pull device for compression release during the starting operation was added to the controls on the dash. The original muffler was found satisfactory in every way for the Diesel-equipped car.

A maximum speed of 55 miles an hour was obtained during the demonstration trip. Getaway was particularly rapid, according to those who took the drive; it is claimed that no gasoline motor car of today could surpass the Diesel automobile in acceleration from a standing start. While the speed of the vehicle is somewhat too slow for individual passenger transport, it seems certain that the Diesel powerplant can be applied efficiently to commercial goods and passenger work and also to tractor propulsion. C. L. Cummins, president of the engine company, who drove the car, found that it handled well in traffic—even in New York—and that a heavy snowstorm failed to hinder the efficiency of operation. The car made the entire journey without adjustments or repairs.

Behind the Human Front

By Edward J. Beck

(*Continued from page* 18)

was deceived. They merely stuck them into a bureau drawer. The black books were not gone."

Then the hotel clerk contributed a specimen of psychology to a growing collection that ought to be good for a page, or at least a footnote in any book of Drs. Freud, Jung or Adler.

"Guests hide the Bible in bureau drawers, usually the bottom one, to get it out of sight," he theorized. "Now it's apparent that for some reason they don't want to see a Bible on the table. Why?

"I have a pretty good hunch it's a matter of conscience. Some of these guests are here for a vacation, coming from some small town. They're out to paint the town red and have their fling. Naughty! Naughty! A Bible in plain view disturbs their consciences and so they deliberately hide it."

A druggist friend who happened to drop the remark that collapsible tooth-paste tubes were one of the minor causes of divorce also had the makings of a psychologist in him. It may or may not be true but anyhow he observed that women, as a rule, "milk" a tube of tooth-paste while their husbands prefer to "wind up" the empty end as the directions advise. Hubby gets peeved and thus mangled tubes lead to marital feuds.

"A measly milk can has been the cause of a lot of similar squabbles," he added. Again the druggist took in a lot of territory when he asserted that women are inclined to punch holes in a milk can (at least one hole) at the center or some distance from the edge. Here also hubby may get on his high horse, and sneer that any fool ought to know that both holes ought to be punched at the edge to prevent dribbling and messing up the can."

Any man whose function it is to size strangers up for their honesty and reliability is likely to have arrived at some interesting conclusions. The writer quizzed the branch manager of a bonding company and asked him if he had ever run across any tell-tale signs whereby one can tell whether the other fellow is lying or not.

"Certainly," he answered. "That's part of my stock in trade. Most of my judgments are intuitive, based on a general impression, but I can give you a couple of rules that usually work out.

"We issue bonds for employes in responsible positions. Our blanks have to be filled out with details of a man's history. I don't know why, but many men lie when we question them as to their past jobs even though they have no particular reason for twisting the facts.

"One little sign often betrays them. They repeat the last part of my question. For example, I ask: 'Where were you working in 1918?' The person being written up replies: 'Where was I working in 1918? I was working for the Brown Wire Co.' 'What were your duties there?' 'My duties there? I was payroll clerk.'

"This practice of repeating questions or parts of questions is one of the commonest devices of the off-hand liar. He seems to be stalling until he can make up a reply. Just listen to a girl at a telephone trying to get out of a date sometime and you'll be able to check up this rule.

The pitch of the voice, continued the surety man, also offers a clue sometimes.

"If I doubt a statement, I induce the speaker to repeat his assertion," he explained. "If he repeats his former statement without raising the pitch of his voice, I gather that he is insincere or untruthful.

"For example, he will say: 'I caught a bass that weighed four pounds.' Then to test him I counter with: 'How much did you say it weighed?' If he answers 'four pounds' in the same pitch, I know he is lying. If he raises his voice as compared with its former level, I am inclined to believe him. Merely increasing the volume of the second statement does not show truthfulness or sincerity but tones in a higher pitch do point that way.'"

Do you know why a person who "talks like a streak" makes you nervous? A sales-manager, who was giving advice to some of his men called in for a sales-conference, cautioned them against such Gatling-gun delivery. He propounded a theory or observation that the mind of a listener can successfully tune in only 20 wave-lengths of thought per minute. More than that produce "static," he said.

"Where do you get an exact figure like 20,' one of his staff interrupted, 'and what are wave-lengths of thought?'"

"I was just ready to go into that," resumed the sales chief. "You eat beefsteak in bites and you pause between bites. The human mind works the same way. It absorbs thoughts by units. And it demands at least a split-second rest between the units.

"Now here's where I get the number 20. We breathe about 20 times a minute. A sentence or unit of thought should be as long as the expiration period of the lungs.

"Thus, you see, the normal wave of attention does not last more than a few seconds. If you're talking to a prospect, 'come up for air'—pause—once in a while.

"If you jabber away, without stopping for these pauses, your listener gets fidgety and irritable. He can only take in 20 idea-units a minute.

"Too short waves of attention, those that are shorter than a full second, are likewise displeasing. Too choppy sentences make the speaker seem nervous and put his listener in the same state."

(*Continued on page* 80)

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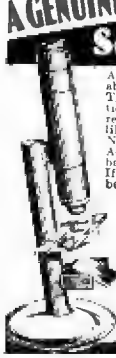

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On the Short Waves

By Robert Hertzberg

(*Continued from page* 30)

advantage of the opportunities the short waves offer, radio fans until recently were forced to use critical battery-operated straight regenerative receivers, innocent of shielding or the benefits of tuned R.F. amplification, and utterly lacking the conveniences of lamp socket operation. This situation discouraged many ex-broadcast fans who had disposed of their batteries with the advent of the A.C. broadcast receiver and who naturally did not want to take a step backward by buying batteries all over again.

Now, however, there is available in kit form a completely A.C. operated short-wave receiver having a *tuned* screen-grid R.F. stage, double shielding and a wavelength range of 14 to 500 meters. This kit was designed particularly for the man who wants to get into the short-wave game at little expense and with little trouble. The set can be assembled and wired in two evenings with the aid of a screwdriver, a Spintite wrench, and a soldering iron, all necessary parts down to the last washer and lug being supplied. The front and sub-panels are accurately drilled, and everything goes in place with gratifying smoothness. This set, known as the "Super-Wasp," has been on the market for about seven months, and has established an international reputation for general effectiveness.

The use of a tuned screen grid R.F. stage gives sensitivity and selectivity far beyond anything obtainable from a straight regenerative outfit, while the double shielding absolutely eliminates hand capacity effects even down to 14 meters. Many problems were encountered in the effort to make this tuned R.F. stage work properly, but they were ironed out by an orderly process of experimentation. Many radio men still doubt the effectiveness of T.R.F. on the short waves, but they forget that not so many years ago T.R.F. on waves as high as 300 meters was considered impracticable, and engineers were forced to use beat-frequency receivers in which the wavelength of the signal was raised, in effect, to a higher value at which R.F. amplification could be accomplished more easily. This was the super-heterodyne idea, if you recall. Radio engineers have learned a few things, and R.F. amplification on 14 or 15 meters is no longer an uncertainty. The R.F. short-wave receiver is just as far ahead of the hay-wire straight regenerator as the modern R.F. broadcast receiver is ahead of the old three-circuit tuner.

The schematic diagram of the "Super-Wasp," along with several views of the completed set, are shown on these pages. You will note that the components of the R.F. and detector stages, respectively, are enclosed within individual shield cans, which in turn are mounted behind a metal panel. The tuning inductances take the form of coils which plug into regular tube sockets. The parts of the two tuned circuits are so laid out that most of the connections are made directly from terminal to terminal, the longest wire being hardly 1½ inches long. The R.F. currents are confined entirely within the can, none of them roaming off into the shielding or the connecting leads. The mechanical arrangement of the parts is to a large extent responsible for the success of the circuit.

A question that naturally arises is: "How much hum is there present?" The answer is that the hum has been reduced to the point where it is hardly noticeable.

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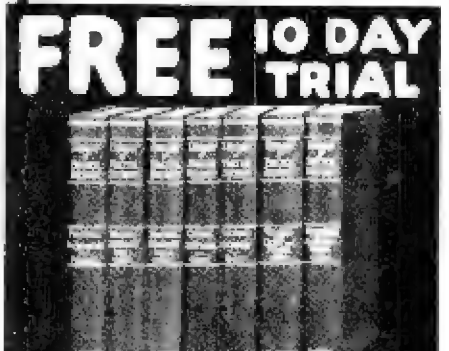

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Does Your Home Need An Umbrella

By S. Gordon Taylor

(*Continued from page 21*)

most effective location because the added insulating value of the air space between the rafters is taken advantage of. This subject was discussed in considerable detail in the last issue of SCIENCE AND INVENTION, in an article on insulation in the home.

The life of roofing materials varies anywhere from six or eight years up. There are records of copper roofs which have been in service for over 500 years and are still in perfect condition, while on the other hand, one occasionally finds a roof in need of repairs after service of only two or three years. The selection of roofing material which will provide long service not only results in freedom from maintenance expense but definitely eliminates the expense involved in repairing plaster or decorations ruined as a result of a leaking roof.

Modern slate shingles of odd dimensions beautify this house. (Penna. Slate Institute.)

Long life and economy are naturally very closely related. If short lived material is employed its subsequent replacement involves not only the added cost of the material for re-roofing, but also a duplication of the original labor cost for installation. Thus, material which can be depended upon to stand up through 20 years of service is worth far more than twice the cost of material which would render only 10 years of useful service. Economy is therefore obviously not a question of first cost but rather one of ultimate cost. This applies whether the material is to be employed for roofing a new home or for re-roofing an existing dwelling.

From the standpoint of appearance, the roofing on a house plays a decidedly important part. Today more than ever before this fact is being realized and as a result owners are giving careful atten-

The charm of a thatched roof is gotten with stained cedar shingles. (Weatherbest Stained Shingle Co.)

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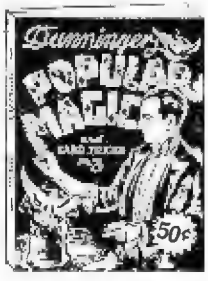

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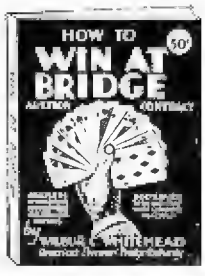

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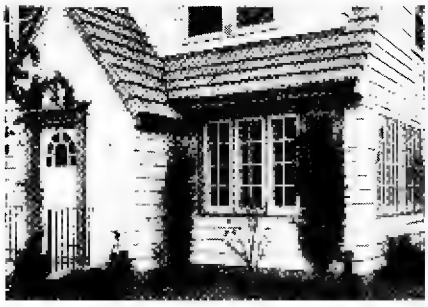
tion to the use of colors and pleasing textures in roof surfacings. In the old days when wood shingles were used almost exclusively, roofs were for the most part rather drab, monotonous affairs because of the absolute regularity of the shingle surface. In sections of the country where slate was prevalent many of the roofs were more attractive in appearance. While they may have been somewhat lifeless as to color, still they offered a variety of shingle width and thicknesses which lent a pleasing variety of shadows. Nowadays any desired effect may be obtained in these and other types of roofing.

This matter of fine appearance will affect the cost to a certain extent, but the owner will usually find that the additional cost is more than justified by the added attractiveness, particularly where the roofing is of long lasting high quality. If color is desired in the roof, the coloring



Waterproof concrete tile in color is used here. (Hawthorne Concrete Products Co.)

should be an integral part of the roofing material—not just a surface dye, stain or paint. Also it should be a fast coloring which will not assume a washed-out appearance in a short time; otherwise the occasional painting or stain required to maintain its good appearance will add to the expense of maintenance.

The choice of roofing materials for the past several years has been almost unlimited. We no longer have to depend upon the "natural" roof, such as wood shingles but in addition have an almost endless variety of composition shingles employing asbestos, asphalt, cement, metal and clay or other mineral products. Some of the manufactured shingles are little if any more expensive than plain wood shingles and lend themselves readily to roofs that are attractive in appearance.

Wood shingles impregnated with preservative stain are moderate in cost. (Creo-Dipt Company.)

Obviously the home owner will be interested in knowing something of the make-up of some of these roofing materials. Wood is undoubtedly still the most commonly used of the shingles, and they are offered in considerable variety. In order to increase the normal life of the old unfinished wood shingle, present day manufacturers are for the most part impregnating the wood with a preservative

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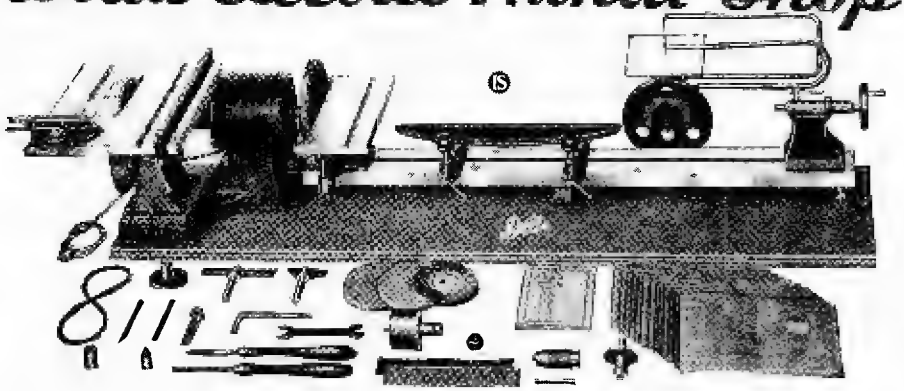

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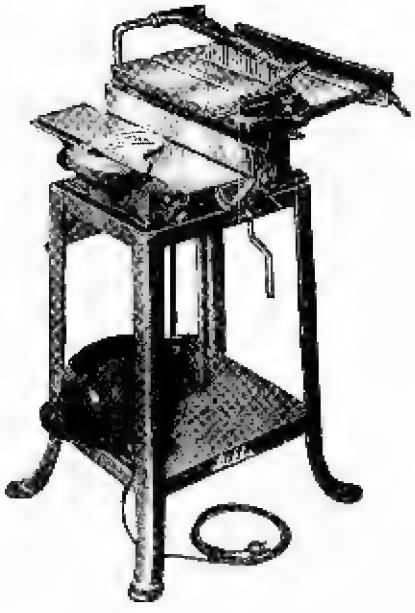

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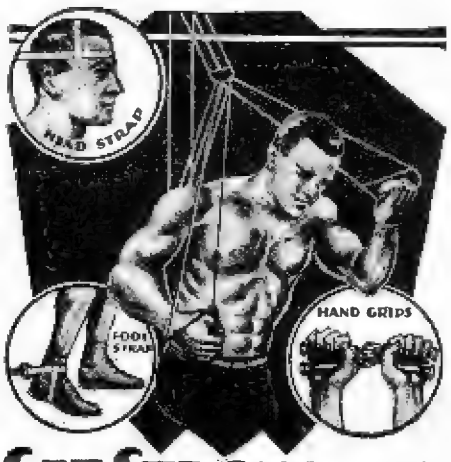

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stain. The best of these are treated under pressure so that the preservative is forced into the structure of the wood itself. The shingles are cut to various thicknesses and widths to provide the popular random effect when installed on a roof. This type of shingle is for the most part inexpensive although some of the special shapes run into the moderate cost class.

The so-called asphalt shingle is rapidly growing in popularity. It is also relatively cheap and is put out in an almost unlimited variety of colors, shapes and textures. Most of the asphalt shingles consist of a base of felt which is completely saturated with asphalt and then given an all-over coating of asphalt. Crushed mineral matter is then applied to one surface. The minerals are selected for their color and in addition protect the asphalt from the action of sand and light thereby greatly increasing its durability.

The Next Article in this Home Improvement Series by S. Gordon Taylor will be on Paints and Decorations for the Home. It will be published in the June issue.

Asbestos shingles are long lived, fireproof and many of them are relatively inexpensive, but at the same time are available in a variety of forms, colors and shapes. They are made of a mixture of cement and asbestos fibre thus combining the durable features of these two minerals into a rigid shingle form which is practically everlasting. Colors are put into the mixture before the shingle is formed and are therefore permanent.

The qualities of slate shingles are so well known that there is little need for discussion of this type except to say that slate shingles are now available in a great many more different forms than in years gone by. Many extremely attractive roof patterns are made possible by the variety of colors in which slate is quarried. Also, pleasing random effects are obtained with this material through mixing slates of different colors, and by employing shingles of varying lengths and thicknesses.

Tile roofing, while generally rather expensive, is finding more and more extensive use in the better class dwellings. It has found increasing use since the popularization of the Spanish and Italian type houses. Good quality tile roofing will outlast any ordinary house and requires no attention of any kind.

Copper is another form of roofing which is as near everlasting as a roof can well be. The Copper and Brass Research Association made an investigation to find out how long a copper roof might be expected to last. They discovered, among other examples, a temple in Japan, which had been erected in 1411, the copper roof on which is still intact after 519 years of service. Copper roofing is available in various forms including shingles, tile and sheet. It is naturally rather expensive, as would be expected of such a material but is comparatively light—considerably lighter than many of the other better grade roofing materials.

For one who is interested in the subject of roofing, it will be found well worthwhile to obtain booklets offered by various roofing manufacturers. A list of some of these booklets will be found on page 84 of this issue.

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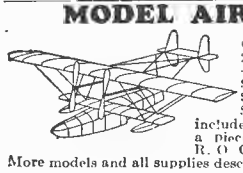

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Foods That Fight Your Stomach

By Frederick Damrau, M. D.

(*Continued from page 32*)

continues to bootleg them into his stomach and the industrious antibodies do their best to destroy the lobster protein. The result is a lifetime of guerrilla warfare between lobster proteins and anti-lobster antibodies.

One person in every seven is abnormally sensitive to some form of protein, whether it be animal dandruff protein, plant pollen protein, or protein food. In such cases cat, dog or horse dandruff may cause asthma; ragweed, timothy, lamb's quarters or wormwood pollen, hay fever and asthma. Food allergy may produce a number of troubles.

I knew an asthmatic old maid who was proved to be sensitive to cat's dandruff. She had a pet cat of which she thought the world, but I didn't. Once, when I was called to see her during a severe attack of asthma, the animal clawed me viciously. Revenge was sweet! When I discovered what caused her asthma, I asked my patient to kill the cat.

Soon afterward I received another hurry call. The cat was still there, but it was stuffed. The stuffed cat was ostracized, but still the asthma continued. It was not until the family in an adjoining apartment, who maintained two very virile tomcats, were bribed to part with their pets that I was able to relieve my patient of her asthmatic attacks.

This experience illustrates how very sensitive some people may be to the inhalation of animal dandruff. In some cases persons susceptible to horse dandruff have suffered from asthma although they lived almost a block away from the nearest stable.

In the case of hay fever, sensitiveness to certain plant pollens may also be extreme. During the season when the guilty weed or grass is in bloom, the victims must either put up with the sneezing and irritation or migrate to sections where the plant does not grow. However, a *desensitization* treatment is now available, by which most of them may be relieved of their pollen sensitiveness.

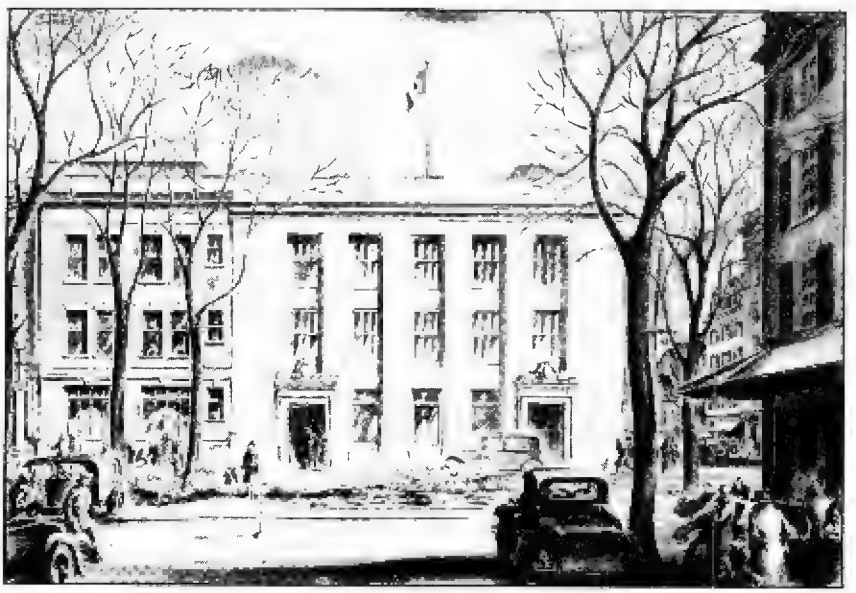
Food proteins act in sensitive people much like the proteins contained in animal dandruff and in pollens. A number of illnesses may result when susceptible persons eat foods which their bodies have prohibited. Among them are upsets of the stomach and intestines, attacks of sick headache, hives and asthma.

A young stenographer came to me with the story that she suffered periodically from excruciating headaches, at which times she thought she saw "the white lights of Broadway" even in the daytime. She had noticed that these attacks of migraine came whenever she ate a banana and that she would frequently have an outbreak of hives at the same time.

Bananas were tabooed, and then the headache and hives stopped. When the girl's arm was gently scratched with a needle and a little banana protein rubbed in, a large red hive promptly appeared. When proteins other than those of banana were used, such as milk and egg proteins, no hive formed. Simply by avoiding bananas this young lady has been able to remain free from attacks of migraine.

How the doctor picks out the particular protein food (or dandruff or pollen) to which his patient is sensitive is a matter of much interest and importance to the unlucky one in seven who happens to suffer from protein sensitiveness.

If one is made sick by banana protein, for example, the skin as well as the rest



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of the body is irritated by it. A gentle scratch is made on the skin of the arm, not so deep as for vaccination. Then a tiny bit of the protein of the banana is rubbed gently into the skin. Should the patient not be susceptible, no inflamation other than that due to the slight irritation follows; but, if the banana really is the trouble-maker, a large red hive soon forms over the scratch.

In some cases the physician is led to suspect from the patient's account which of the seventy-two foods in the protein rogues' gallery is responsible. Unfortunately, the patient's story may prove misleading, as he is only to likely to shift the blame to some food which he dislikes. Moreover, one may be sensitive to two, three or more proteins. Therefore, it is usually necessary to run the patient through the whole scale of protein skin tests in order to have a complete understanding of the case.

Patients going through the skin tests have a humorous habit of saying that they are being "tatooed." The repetition of scratches may indeed suggest an enlistment in the Navy, but the irritation lasts only a few days and no scar results.

To reduce the required number of scratches to a minimum, the various protein substances have been arranged in groups by some workers. For instance, the shellfish group contains clam, oyster, crab, lobster, scallop and shrimp proteins; the bean-and-pea group: kidney bean, lentil, lima bean, navy bean and pea proteins. If the skin test for the group is negative—that is, no hive forms after the group of proteins has been rubbed in—we know that the patient is not sensitive to any of the members of the group.

Desensitization

Having discovered by the skin tests which food or foods disagree with his patient, the doctor must next turn his attention to treatment. Sometimes he problem is very simple. I am acquainted with the case of a "grass widower" suffering from hives who proved susceptible to garlic protein and was, in fact, in the habit of eating raw garlic. His halitosis was devastating. By simply eschewing garlic he was cured simultaneously of both hives and halitosis, and his wife returned to live with him. A happy ending for what threatened to be a garlic tragedy!

Suppose, on the other hand, one should prove sensitive to a group of essential foods, such as eggs, wheat and milk. It would be almost impossible to forbid these articles of diet and still sustain life.

In that event we should have to resort to *desensitization*, another of the marvels of medical science. Let us suppose that the theatrical producer whose case I have mentioned had proved susceptible to lobsters, as I suspected at first. It would have been a waste of words to ask him to stop eating lobsters.

"Consider my career," he might have answered. "The Follies cannot go on without the midnight lobster."

And so, in the interests of "the white lights of Broadway," the correct procedure would have been to desensitize against lobster protein. The technique would have been as follows: An extremely tiny amount of lobster protein—not enough to produce a hive or cause illness—would be injected with a fine hypodermic needle. Subsequent injections would be made with increasing amounts of lobster protein, but never enough to produce illness. Under this treatment resistance to lobster protein would gradually be increased. Finally the desensitization would become so complete as to allow the impresario to eat all the lobster that his profession required.

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Your Glider's Flying Clothes

By Lieut. H. A. Reynolds

(*Continued from page 39*)

butt end of the wing. Next draw the cloth to smoothness (not stretched tight) and fasten it with glue and pins to the ¾-inch half round strip at the wing tip. Rub each glued rib with your hands so that the cloth absorbs some of the glue and occasionally put in a push pin to hold the cloth in position. Next apply more glue to each rib and continue fastening the cloth back towards the trailing edge by unrolling your panel as you go. Do not spread the glue over too large a section of ribs at one time. If you cover too large a section with the glue it will become too dry before you can fasten all the cloth needed to cover it. As you proceed in this manner and the glue first applied dries, you can pry out the push pins in this dry section and use them over again. The push pins will not split the spruce rib battens and are easily pried out leaving the cloth securely glued to the surface of the wing. Continue covering the bottom surface of the wing, but do not glue the trailing edge or rib tips at this time. A small slit can be cut in the cloth at each wire connection as an outlet for the wire. These wire outlets can be reinforced with cloth patches cut to shape and glued in place later when the true course of the wire can be estimated Trim away the excess cloth so that the aileron horn will slip through and cover the bottom of the aileron. The trailing edge of the aileron must be in line with the trailing edge of the wing during this covering process. After all of the glued cloth connections are dry the push pins may be removed and the wing turned over right side up on the sawhorses. The top surface of the wing and aileron can be covered in the same manner starting at the trailing edge and working slowly towards the leading edge. The aileron can be cut out from the wing and removed so that its butt rib can be covered on the side. This is done by gluing in a shaped piece of cloth. The side of the wing rib next to the aileron should also be covered with a piece of cloth cut to shape and glued in place. Do not be discouraged if slight depressions should appear in the cloth here and there between the ribs for the shrinking caused by the dope will make this disappear later. Cover both wings in the same manner. Trim off the excess cloth which will overlap along the leading edge and wing tips.

The triangular stabilizer framework can be laid on a double thickness of cloth and its pointed outline marked for sewing. Do not sew the spar edge of the stabilizer covering. After sewing the two sides leading to its pointed front the cloth can be turned inside out and the stabilizer inserted through the open back side. The stabilizer framework should be well covered with glue and the triangular shaped cloth bag covering drawn over it. Fasten it temporarily with push pins.

The outline of the elevators can be drawn on double layers of cloth so that they may be sewed into tight fitting bag-shaped covers which when turned inside out can be drawn over the elevator framework and glued fast. Turning these sewed-up coverings inside out places the sewed seams on the inside and presents a smooth good looking surface on the outside. The cloth should be cut away at the horn positions so that no wrinkles will be present in the finished covering.

(*Continued on page 77*)

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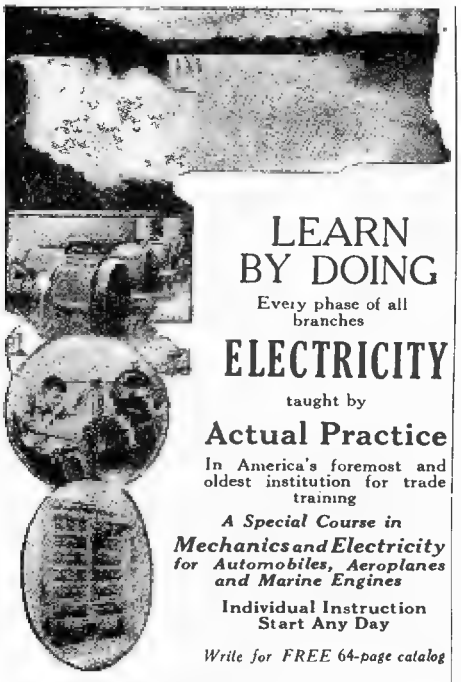

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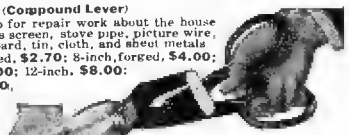

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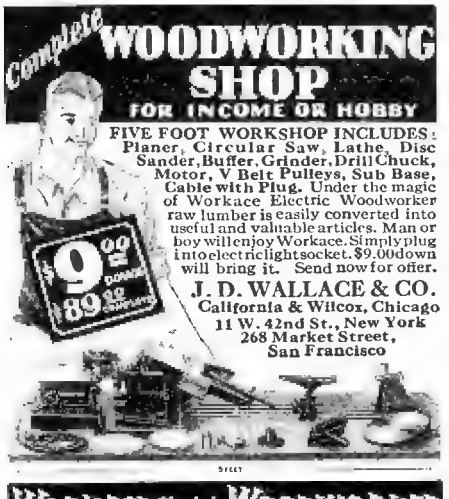

FIVE FOOT WORKSHOP INCLUDES: Planer, Circular Saw, Lathe, Disc Sander, Buffer, Grinder, Drill Chuck, Motor, V Belt Pulleys, Sub Base, Cable with Plug. Under the magic of Workace Electric Woodworker raw lumber is easily converted into useful and valuable articles. Man or boy will enjoy Workace. Simply plug into electric light socket. $9.00 down will bring it. Send now for offer.

$9.00 DOWN $89.00 Complete

J. D. WALLACE & CO.

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268 Market Street, San Francisco

WORKACE Electric WOODWORKER

The Safety Valve

(*Continued from page 53*)

Now suppose we determine the value of the prize. Is it going to be $250.00 or $500.00 or only $100.00? Decide that first and then maybe it would be better to have a first, second and third prize. Then notify the winners and find out what they want for a prize. For instance, a radio amateur (me) would select such articles as 1. quartz crystal. 1. UX852 tube. 2. UX866's, etc. until the selections amounted to that amount which he won as a prize. In no case send the actual cash as a prize, but only merchandise, and the merchandise must be of a scientific, experimental or practical nature, other than groceries, fuel, clothing and such necessities of life. You can readily see the logic in this. The financially poor winner would, through duty to his family, select merchandise that would in no way aid him in his chosen hobby or profession, but would aid his family instead.

As to contests, let them pertain to such things as mechanical skill, wood-craft, puzzles, powers of observation, intelligence tests, and hobbies such as pictures of the den, laboratory, home shop, or radio station.

Don't you think this would work a lot better? The model builders have grabbed the gravy for a long time now, so why not let someone else have a chance at a nice prize?

AMOS UTTERBACK,
Whiting, Ind.

(Lathes can now be obtained at the price of a couple of square meals. Will some of those who have won cups in the Model Contest of SCIENCE AND INVENTION *Magazine answer Mr. Utterback's letter stressing the garlic inference?*

We are perfectly willing to let anybody enter our contests and we want to make their appeal as universal as possible. See answer to Kepplinger's communication.— EDITOR.)

IN RADIO NEWS *for May*

Lieutenant Wenstrom, in another of his illuminating articles, tells how by means of short wave radio and observation of sunspots, it is possible to attempt the forecasting of weather and radio conditions.

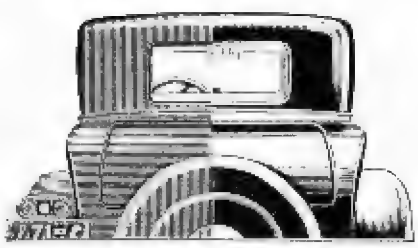
Full construction details for a one-tube tuner to go with the Loftin-White amplifier are contained in an article by John B. Brennan. Specially designed for the job, this simple tuner is amazingly selective and sensitive.

For the serviceman, George Fleming tells how to build a simple set analyzer and tube tester. The construction is such as to make the assembly entirely portable.

Walter S. Bullock, in the second of a series of articles, gives full constructional details for a compact auto-radio receiver.

Messrs. Loftin and White present another of their highly interesting articles on the Loftin-White system of audio frequency amplification.

How to build a fly-weight receiver for plane, glider, or outboard motor boat. "A Tube Story." by Dr. Lee DeForest; "Radio In Every Room." by S. Gordon Taylor, another automobile radio receiver article by Gilbert Brown, are only a few of those contained in the May issue of RADIO NEWS.



New Fluid Restores Finish of Old Autos

Unquestionably this is one of the greatest discoveries in the automobile field. Think of it! A marvelous liquid called NUREX, almost magical in its effect, does away entirely with all polishes and waxes.

WITH A SWEEP OF THE HAND

NUREX requires no rubbing, painting, cleaning nor waxing. Just a sweep of the hand and the drab, dull surface vanishes before your eyes and the hidden color gleams forth with wonderful lustre. Your car then looks like it just came from a paint shop and the beautiful new finish will last indefinitely.

PAYS YOU EASILY $100 PER WEEK

By merely showing NUREX you will make big money. Every car owner to whom you demonstrate will buy. Sales rapidly multiply. Every sale brings you enormous repeat business. In your spare time you can easily make from $5 to $10 an hour with little effort.

REFINISH YOUR OWN CAR FREE

We are now appointing men in various localities to take care of the big demand. A sample supply of NUREX is furnished FREE to workers. Just write and say, "Send me your FREE sample and big money making offer."

Nurex Products Co., Sta. C, Dept. 210, Milwaukee, Wis.

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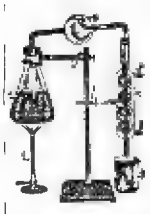
QUICK, SURE, LASTING RESULTS

In most cases, ***Tobacco Redeemer*** relieves craving for tobacco completely in a very few days. An absolutely safe, dependable, and thoroughly reliable treatment. No matter how long the habit, or in what form used, all craving for tobacco usually vanishes when this pleasant, inexpensive treatment is used according to simple directions. Your money returned without argument or question if not satisfied. Write for free explanatory booklet and proof of what ***Tobacco Redeemer*** has done for men addicted to the tobacco habit. Send post card or letter today.

NEWELL PHARMACAL CO.,
Dept. 884 Clayton Station St. Louis, Mo.



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Hooked up in a few minutes. Use same tubes—no changes. You'll be amazed at the improvement in reception and distance getting. Send name and address today for full details, proof and Free Trial Offer.

TOWNSEND LABORATORIES
725 Townsend Street Chicago, Illinois

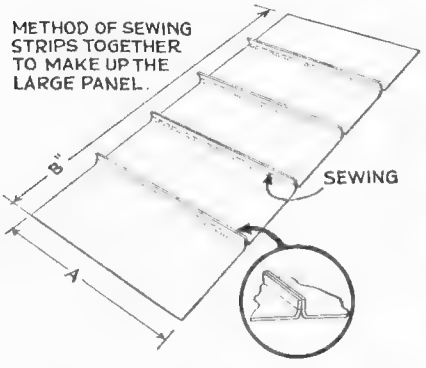
Your Glider's Flying Clothes

(*Continued from page 75*)

The rudder can be covered in the same manner as the wings. The plywood top of the rudder can be left uncovered if the builder desires.

It will require about 10 gallons of clear nitrate wing dope to render the wing and tail surfaces airtight and smooth. The Phenix Aircraft Products Company, Williamsville, N. Y., sells a No. 560 clear nitrate dope for $1.55 a gallon which proved very satisfactory to the writer. Wing dope may be procured from nearly all of the aircraft supply firms in the country. Aluminum pigment for coloring the dope can be supplied by the Heath Company at $1.25 a pound. Most builders do not color the cloth as the doping job usually leaves the wings nearly white and smooth. The builder will discover that he will have a little dope left from the ten gallons advised and this will come in very conveniently for sticking repair patches in place later. Nitrate dope is a fast drying adhesive for cloth and holds as firmly as the casein glue.

The brush method of applying dope is much more convenient than spraying, which requires special equipment. A good brush is needed of about four or five inch bristle width. Pour a small quantity of dope into a deep wide-topped basin and brush it along the surface covering a small area each time the brush is dipped. Avoid flame as the dope is highly explosive and keep the main supply tightly corked to avoid evaporation. In this manner the dope does not come in contact with the air long enough to thicken before it is applied to the cloth. After all the cloth surfaces of the glider have been given a first coat of dope trim up the ragged edges that were left when gluing the cloth during the covering operation. Strips of the wing covering cloth may be cut for this purpose. They should be cut as long as possible and be about 1¼ inch in width. If a real good looking job is desired the Marvin A. Northrop Airplane Company, 730 Washington Avenue, North, Minneapolis, Minn., can supply a 2-inch pinked edge cloth tape at 5 cents a yard that is made for this special purpose. About 100 feet of this trimming tape will be required. These cloth strips must be thoroughly saturated with the wing dope and stuck to the wing covering by brushing down with the doping brush. The leading edge must be trimmed in this manner and also the spar edges of the aileron openings at the back of the wings can be outlined with tape at this time.



The ailerons, stabilizer, elevators, and rudder are all trimmed with this finishing tape. By fastening these strips of finishing cloth over the unsightly seams you

(*Continued on page 93*)

If you are ambitious—want to earn big money as a draftsman—copy this sketch and mail to me. If I think you show talent I will send you, direct from my drafting room, a handmade Airplane blue print in three views with all main parts named and explained. Also FREE my two books, "My Pay Raising Plan," and "Successful Draftsmanship." They tell all about this fascinating profession and my working method by which I train you right in your own home. No matter what your schooling or what you are doing now clip the coupon and learn what I can do for you

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Earn Up to $100 a Week!

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No need to leave home or quit your job. Not only do I give you complete practical drafting room training at home—but I show you how to earn while you are learning—in a few short weeks after you start.

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After training you, I help you get a good job without charging you a cent for this service. Employers come to me for men because they know that Dobe Trained Men make good

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I furnish you all tools AT ONCE, with my training, NO EXTRA CHARGE.

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FREE

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1951 Lawrence Ave., Chicago

I am attaching sketch of Airplane. Send me the three-view blue print, as offered. Also your two books—all free to me.

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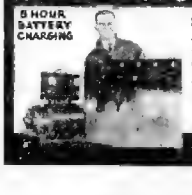

Start a BIG PROFIT-MAKING BUSINESS of your own—"5 Hour Battery Charging Requires SMALL SPACE AND PRACTICALLY NO INVESTMENT. Anyone can successfully operate. Charges batteries in 1/3 the time at ⅓ the cost. EVERY CAR OWNER A CUSTOMER. 20 minute Car Washing, Electrical Service, Spray Painting and Arc Welding offer same opportunity. HB shouldn't cost you a cent—it will pay for itself on EASY MONTHLY PAYMENT PLAN, with practically no expense and with a handsome profit for you. WRITE NOW for details stating what you're interested in to Hobart Brothers, Box S-50, Troy, Ohio.

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Find Radio Troubles in 30 Seconds

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The Easiest Way to Learn Radio!

HAVE you ever invited friends to listen to a good radio program and then been keenly embarrassed because your radio wouldn't work? Has your radio reception ever been distorted or imperfect just when you wanted to hear every word distinctly? Most of us *have had* such experiences, and most of us *will have them* for years to come.

That's why our staff of expert radio engineers has especially prepared this RADIO TROUBLE FINDER volume for you. In times of need, it's worth its weight in gold. In simple words and easy-to-understand pictures and diagrams, it shows you just how to find and correct any radio trouble *quickly*.

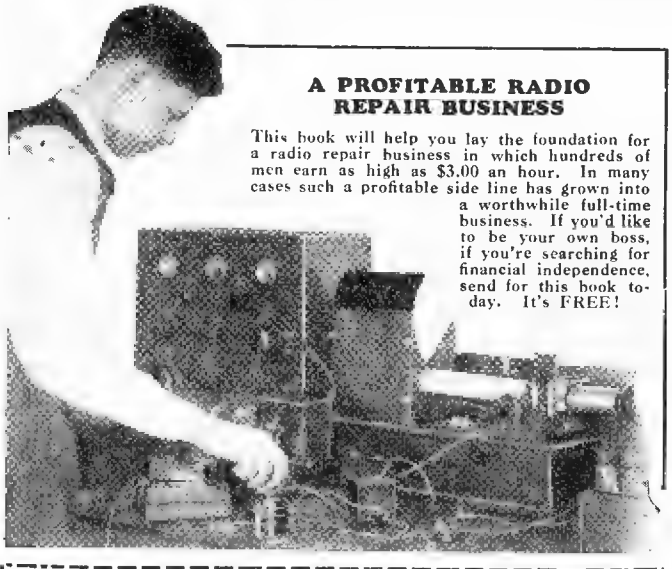
Simple Charts Show You How

In the fastest form of reading—*by charts*—you learn at once what to do when tubes do not light; when tubes light and you get no reception; when your reception is weak. What to do when you get a hum or whistle; when your reception fluctuates; when your reception is distorted; or when your power device overheats.

After you have read this RADIO TROUBLE FINDER volume, you will know how to locate any kind of radio difficulty, and how to repair it in a jiffy!

Over a hundred thousand set owners already have the RADIO TROUBLE FINDER constantly at their elbows. They know that with it at hand they can depend on getting whatever radio programs they want, *when they want them!* Thousands have used the knowledge gained from this handy volume to make marked improvements in the reception of their sets, and in repairing the sets of friends. In many cases it has been the basis for starting a very profitable radio repair business.

These good people have had to pay real money for the RADIO TROUBLE FINDER. BUT, we have set aside a copy to be shipped to you, prepaid, ABSOLUTELY FREE!



A PROFITABLE RADIO REPAIR BUSINESS

This book will help you lay the foundation for a radio repair business in which hundreds of men earn as high as $3.00 an hour. In many cases such a profitable side line has grown into a worthwhile full-time business. If you'd like to be your own boss, if you're searching for financial independence, send for this book today. It's FREE!

A Gift from RADIO NEWS

We are offering you this remarkable volume FREE as an unprecedented reward for your merely accepting a six months' cut-rate introductory subscription to RADIO NEWS, the world's greatest radio magazine that no set owner should be without.

Do you want to know all about new sets and latest improvements? Would you like to know what goes on behind the scenes of the big broadcast stations and the inside stories of broadcast programs and artists? Do you know how to tell a good loudspeaker from a bad one? How to construct the latest power-supply unit? How to save money in servicing your set? *It's all in* RADIO NEWS!

If you are a DX fan, you'd probably like to have a list of every broadcasting station in the world. Or perhaps you'd like to experience the thrill of hearing foreign continents direct with a modern short wave receiver. Or perhaps it's television, auto radios, aviation radio telephony, or the projection and filming of talkies that interests you? *Frankly, whatever it is, if it's radio news you will find it in* RADIO NEWS!

That's why RADIO NEWS has practically twice as many readers as any other radio magazine. That's why you should read it too!

Send for Your FREE TROUBLE FINDER Volume TODAY!

Simply mail the coupon below and we will ship you your copy of the complete TROUBLE FINDER volume by return mail ENTIRELY FREE—at the same time entering your subscription to RADIO NEWS for the next six months at only $1, saving you 50c on its regular newsstand value!

You risk nothing! If you are not more than satisfied, we will refund your $1 immediately and you keep the TROUBLE FINDER book with our compliments. BUT, mail the coupon at once—while we still have books in stock!

RADIO NEWS, (A MACKINNON-FLY PUBLICATION),
Dept. 2505, 381 Fourth Avenue, New York, N. Y.

Gentlemen: Ship me ENTIRELY FREE, postpaid, a copy of your RADIO TROUBLE FINDER volume—at the same time entering my subscription for the next 6 big issues of RADIO NEWS at only $1 which I enclose. (Regular newsstand value $1.50.) If I am not more than satisfied with my first issue of RADIO NEWS, you will refund my $1 but I may keep the TROUBLE FINDER volume whether I remain a subscriber or not.

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Are you a serviceman ☐ ? Dealer ☐ ? Engineer ☐ ? Experimenter ☐ ?

Rustless Steel *to the* Fore

By W. A. Simmons

ALLEGHANY metal is a rustless steel which, though several years old, is one of the latest steel alloys made available in quantity for wide industrial and building use.

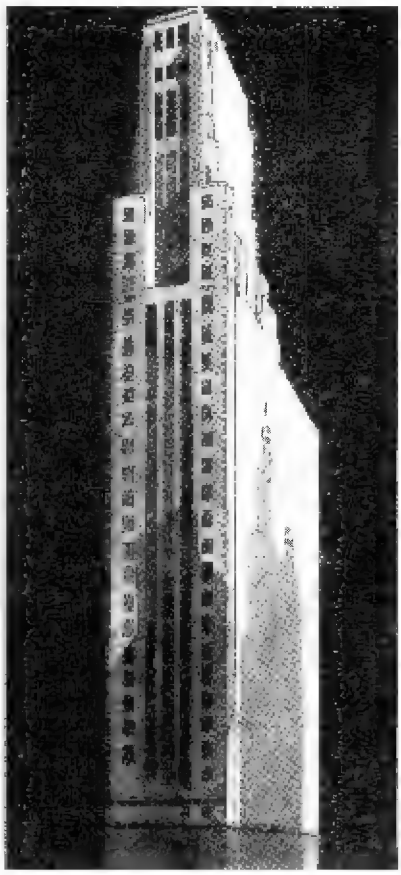
It was a World War discovery and was developed by German armament makers for gun lining. It contains 18 percent of chromium, 8 percent nickel, and smaller proportions of carbon, manganese, phosphorus, sulphur and silicon, which are combined with refined steel by a complicated method.

One of the hardest metals in the steel industry, it is also rustless, untarnishable, non-corrosive, impervious to weather, and needs only be washed in soap and water to keep its brightness.

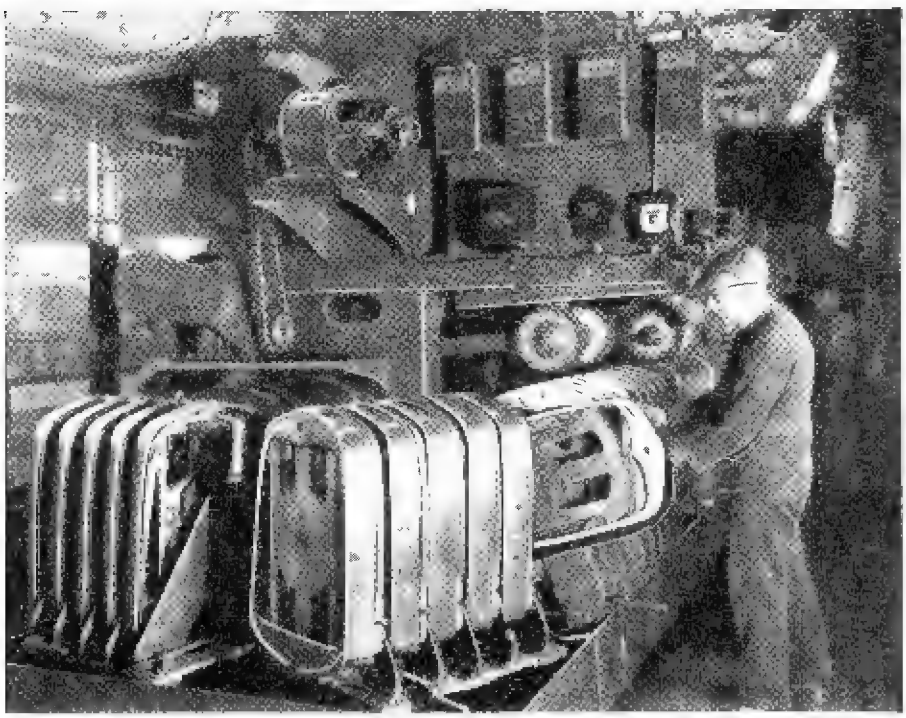
The Ford Motor Company is the first large commercial plant to feature rustless steel. In the redesigned Model A Ford it is used for exterior polished sections, displacing plated parts. About 1,000 tons a month are used by Ford—two-thirds of the entire output of the United States and one-third of the world's!

Before its adoption for use on motor cars, rustless steel was subjected to exhaustive tests and intensive fabricating experimentation. Several hours of exposure to brine spray, about the severest rust and corrosion test known, produced no ill effects; Ford officials state that tests for tensile strength under varying conditions showed its resistance to be greater than that of steel. Several million dollars' worth of equipment installed for use with the nickel exterior of the original Model A have been scrapped.

Previously, rustless steel had been used on a limited scale for bridge construction, building ornamentation and other purposes requiring a bright, extra strong, non-corroding metal.



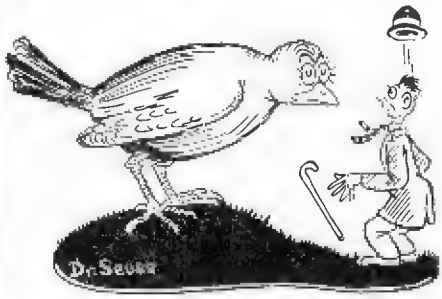
Before long we may have buildings made entirely of rustless steel.



Conveyers carry Ford Model A rustless steel radiator shells past the polishers.

Now it is being adopted for hospital operating room equipment and cooking utensils because its comparative immunity to organic acid reactions makes it especially suitable from the hygienic standpoint.

$500.00 REWARD



WANTED

John Sparrow

(alias "Nuisance," alias "English")

John Sparrow—one of the most brazen of outlaws—is sought on two major offenses.

He roosts on housetops, defaces gables, ledges, windows and awnings, and nests in drain pipes.

This culprit's open hostility drives away welcome songbirds, replacing their musical notes with his "cheep, cheep, cheep."

John Sparrow should be tarred as well as feathered. Or, better still, he should be shot with a CROSMAN SILENT .22—the most amazing gun ever invented for shooting targets and killing small game, furred or feathered. Hence the

$500.00 REWARD

for making such criminals, now at large, as silent as the Crosman Silent .22 itself, the rifle that has six features found in no .22 firearm. For full information on the Crosman Rogues' Gallery and the valuable rewards for the capture of the outlaws, write us now or see your Crosman dealer.

Crosman Silent .22 Repeater

Crosman Pell

CROSMAN ARMS COMPANY
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CROSMAN RIFLES
SILENT .22
POWER WITHOUT POWDER"

RADIO reception may be made much more enjoyable by plugging in a Falck Claroceptor between the light socket and your set. By blocking out the line interference noises, this wonderful device also helps selectivity and distance. Tested, proved. Thousands now in successful use all over America. No change required in your set. Only equipment of the kind. Compact size: 3½ x 5½ x 2½". Made by pioneer radio manufacturer. At radio parts dealers, or write us for new free folder.

Falck **$7.50** *(With Cord and Plug)*

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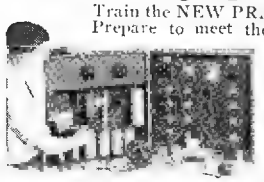
Electro-Technician
By this Amazing New Method

Train the NEW PRACTICAL WAY! Prepare to meet the tremendous demand for Electro-Technicians in all branches of electricity. Splendid opportunities. BIG PAY for trained men. Now is the time to start.



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FREE 48-PAGE BOOK

Write today for FREE illustrated 48 page book giving full details of how you can become an ELECTRO-TECHNICIAN by the wonderful new Home Shop-Laboratory Method. No obligations. Mention age.

Dept. 29, EXTENSION DIVISION

SCHOOL of ENGINEERING of Milwaukee

How Giant "Moles" Bore Under Streets

By Josef W. Von Stein

(Continued from page 40)

rotation of the cutting head (which is adjustable for various diameters) and the forward feed of the machine is automatically controlled by the character of the material through which the machine is cutting its way, the compressed air supply being used only as and when needed. The carriage consists of two parts. The horizontal carriage carrying the revolving head is moved forward one, two or three inches per revolution. This part is interconnected by means of a giant feed screw with a rigid vertical supporting carriage or frame held stationary by being braced against the interior of the tunnel or being otherwise securely held rigid. After the head has advanced five feet, the feed screw is reversed and this carriage is then moved forward to a new starting position. The main shaft, which rotates the head, is twelve inches in diameter and twenty feet long.

The excavated material is automatically deposited on an endless belt conveyor, which carries it to the rear and loads in into wheeled conveyors, to be taken away and dumped.

Behind the Human Front

(Continued from page 68)

Perhaps this same theory explains why the "came-the-dawn" school of writers, those who write in mangled sentences and wear out the exclamation points on their typewriters, get on your nerves. There is no rhythm, or pleasing thought-grouping in their sentences.

Diagnosing bores and how they get that way is a profitable exercise for the amateur psychologist who is cultivating his powers of analysis.

You know when you're being bored—so ask yourself why?

If it's simply that you don't know what the other fellow is talking about or that you are fed up on or not interested in his subject, that's too easy a case to wonder about. Take the fellow who *does* have an interesting subject, and still bores you.

George Garton, who sits behind a desk in the reception room of a big newspaper, has learned to look pleasant even though he does often suffer from acute fatigue in the ears.

He's the man to whom the cranks and fanatics sputter their panaceas and grievances. George says they're not half as hard to listen to—they're often amusing—as certain intelligent callers with something worth saying on their chests but trying bores nevertheless.

"What makes them bores? I'll tell you," George contributed to this collection of psychological lowdowns. "A fellow often bores you because his tongue doesn't keep up with your brain. He goes into so many details that your mind is always three jumps ahead of his story. You tug at his leash of words and he pays it out so slowly.

"A conversation has to have some suspense in it, just like a movie. You'll be kept interested if you are kept guessing from sentence to sentence what is coming next. A lot of people who come in here don't seem to give me credit for any imagination at all. They advance their propositions like a fellow paying an election bet by pushing a peanut along the street with his nose. It tires you all out following them so slowly."

Earn $3.00 An Hour
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Build a Boat for $3.62

By Hi Sibley

(*Continued from page* 41)

which is hard to make watertight, a sort of lee board was used, hung on the gunwale of the leeward side. This is simply a board with iron hangers at the top and a lead weight along the bottom edge. It can be readily shifted from side to side, as required. The oars are easily made from spruce and thin wood, one of them used as a rudder.

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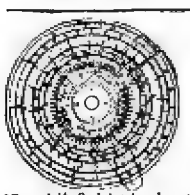

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A Pole Screen

By H. L. Weatherby

(*Continued from page* 48)

screen, the writer recommends that the pole part be turned in three sections, as suggested in the drawings. The vibration on a slender piece, if the length is great, will become excessive and the quality of the work will suffer. Mortises fitting the legs should be cut or holes bored for dowels before the turning is done.

The brace or piece that makes possible the sliding frame is clearly shown in the drawings. Its shape may be altered to permit the frame to slide either higher or lower by making it deeper in the middle, and throwing the frame farther from the pole to permit it to pass the thick portions. A hole with a keyway is cut, and a small wooden key for locking the frame is made to fit.

In assembling the legs to the post it would be well to drive small finish nails into the post at an angle, instead of using clamps, which are difficult to place on the curved legs.

A coat of filler, a couple of coats of white shellac, two or more coats of varnish rubbed to a velvety finish, a piece of beautiful needle work in the frame—and the job is done. And it will be prized and treasured as a true piece of handicraft deserves to be.

For its practical use, set it where it will shield the face as you sit by the fire, or protect the eyes from a glaring light in the room as one reads; and you will find that it has its practical as well as ornamental value.

Book Reviews

THE NEW WORLD OF PHYSICAL DISCOVERY, by Floyd L. Darrow. The Bobbs-Merrill Co., Indianapolis, 358 pages.

This is a sister book to Mr. Darrow's "Story of Chemistry," and parallels the function of the latter in the field of physics. It provides a bird's eye view of the entire field of physical research, from the early primitive races to the present time, when man has to a great extent obtained a mastery of physical laws and forces which enable him to dominate the earth.

Within comparatively few pages the author has outlined the physical discoveries which have resulted through accident and persevering research. He has showed good judgment in the material selected—particularly clear are the chapters on "Heat," "The Rise of Electricity," and "Relativity for Everybody." The last mentioned, of course, is a popularized version of Einstein's Theory of Relativity, and explains simply why "two observers of the same event may arrive at totally different judgment of what has happened, and both be right," and why "the relative motion of one body with respect to another is all we can ever observe."

Due credit is given the Egyptians, Babylonians, Greeks for their discoveries, and the Mesopotamians for their mastery of hydraulic engineering. The practical significance of the scientist's work is brought out wherever possible. For example, Black's discovery of the latent heat of vaporization is shown as the forerunner of pressure cookers. The present research work in laboratories is correlated with our latest means of communication, transportation and living in general.

Naturally, the book is written in popular

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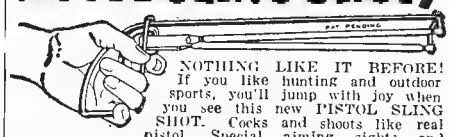

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style and is free of all mathematical formulae and complicated reasoning. While it serves for the layman and casual inquirer, it is neither deep nor thorough enough for the real student of physics.

THE MASTER OF DESTINY, a Biography of the Brain, by Frederick Tilney, M.D., Doubleday, Doran & Co., Inc., New York, 343 pages.

Dr. Tilney has been studying the brains of human and lower animals for more than twenty years, and in this book summarizes his findings, as well as those of others in the field. He traces the development of the brain from its beginning in the single-celled unit of life to the present time—and points out that we are in an intermediate stage of development at present.

The brain evolved with the need for a central controlling body. It definitely provides a link in the evolutionary theory, for our brain "gives numerous signs indicating its primitive origin from the lowest of the vertebrates, the fish. It bears identifying marks of intimate association with animals of its own class, the mammals," and "it has a large number of details in its special mechanism possessed in common with all of the primate order, to which man belongs, together with the lemurs, tarsiers, monkeys and apes."

Dr. Tilney believes that the brain, hand, and foot are one functional unit, and that the four-handed stage of animal existence led to the highest brain development. The development of the human foot to establish erect posture, the freeing of the hand in consequence of such a position, the expansion of sight and hearing, the development of speech and the establishment of human personality and the growth of higher mental faculties come in natural sequence.

The greatest possibilities of further progress lie in the expansion of the frontal lobe, our sense combiner. But, granting future development of this organ, Dr. Tilney is not optimistic. He believes that the average person uses about one-fourth of his brain under normal conditions. And, during times of stress, such as our recent World War, man's veneer of control over his own nature cracks, and in spite of centuries of training he shows himself to be little above his lower brothers.

Dr. Tilney writes in a clear, interesting style. He treats his subject with proper dignity and does not abbreviate material which requires detailed explanation.

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MADNESS OF THE DUST, by R. F. Starzl. Although this story was written some time ago, an extract taken from *The New York Times* of December 21, 1929, gives almost word for word a similar description of an operation performed by a ship's Captain, following radio instructions from a physician. But this is only an incident in an unusual story, excellently told.

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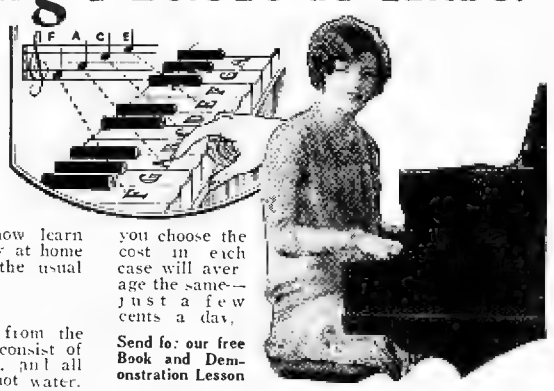
To those who think Learning Music is hard-



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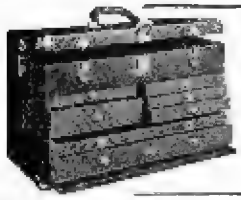

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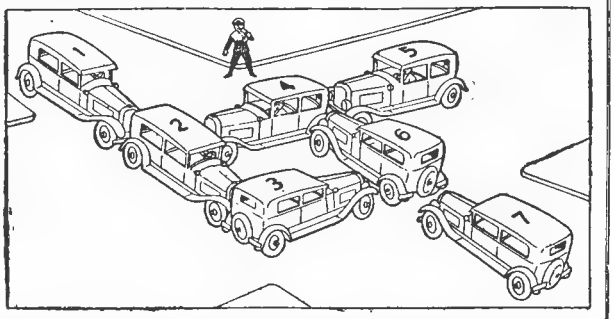

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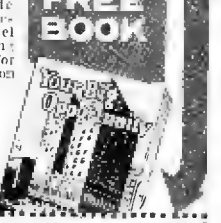

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FORECAST

By the Official Forecaster

EVER hear of Norman Bel Geddes? Designer of Toledo scales and of the cathedral scenery for The Miracle? Builder of complicated miniature race-tracks and writer of plays? . . . SCIENCE AND INVENTION for June will carry an interview with this **craftsman-artist-engineer** of our time—an interview as fascinating as an interview with Leonardo da Vinci might be, were he alive today.

AND William Watts Chaplin will come through with another of his **dramatic close-ups** of great moments in modern science. This one will be called "The Sky Talkers," and will recount the success of airplane-to-earth-telephony as it seemed to a man who through an assignment and a lucky break had the good fortune to experience it at close range.

S. GORDON TAYLOR continues his Home Improvement series with a discussion of **paints and decorations** for the home—a subject which will prove absorbing to everyone who realizes what an important factor in attractiveness color has come to be. . . . And supplementing this article will be one on the merchandising value of color by our financial editor, Alfred M. Caddell.

DON'T overlook the fact that the SCIENCE AND INVENTION **Basement Plan Contest** closes May 31 at midnight—which means that every plan must have been received at our office by that hour. So if you have a basement conversion plan in mind, put it on paper at once and give it to the air-mailman. That's the only way to avoid regrets and connect with your share of the $400 we are offering in cash awards for the best plans submitted. . . . You'll find a digest of the contest rules on Page 63 of the present number of this magazine, and a list of manufacturers' booklets which may help you with the material and equipment part of your plan on Page 84.

MARTIN H. SCHEMPP, author of 'Riding the Thunderclouds," is slated in the June number for a how-to-make-it article describing the construction of a **one-man glider release trap**—an article of first-rate importance to the generation learning to fly by motorless means. Pilot Schempp knows gliders from the Rhoen soarers to the motor-towed primaries of the Michigan flats. You can put down odds now, without second thought, that his trap will prove a practical piece of equipment for any glider club that wants it badly enough to build it. . . . And the June number will carry other glider features, too, of the most pertinent and interesting sort.

TRAFFIC **in Cleveland** and the **scientific wonders of Philadelphia** are scheduled as the contributions for June in these extremely vital fields. We have an idea that what is most needed right now is a series that will picture comprehensively the progress being made throughout the country in solving the traffic problem, and it is our hope that our group of traffic articles will promote a helpful interchange of methods and equipment which have proved effective.

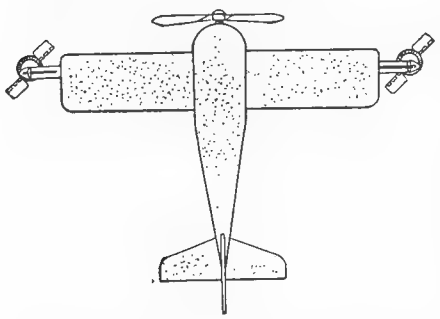
Rotary Ailerons and Other Novel Control Devices

By Augustus Post, *Aviation Editor*

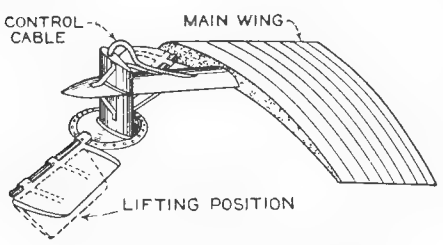
What we call flying is far from perfect. It resembles Baron Munchausen's famous trip into and out of a besieged fortress, riding on a cannon ball. "Shooting" mails and passengers is speedy transportation and can be performed safely by an expert, but it is not the kind of flying that we see when a pair of swallows build their nest.

What is it that enables birds to fly with such ease? Birds' wings are not solid, but have many joints, muscles and nerves. They can bend them into many forms and increase and decrease the lifting surface beside obtaining direct lift by beating the air.

Positive control has long been desired as a means of keeping an airplane in the proper condition when it is "stalled" or has lost headway on account of climbing at too steep an angle, or when flying too slowly for the ordinary type of ailerons to function in their proper manner and to keep the airplane in balance.



The method of using small revolving propellers, mounted at the wingtips, provided with variable pitch blades, as shown in the above diagram, has been patented by Mr. Carl Dienstbach, one of the noted German authorities on aeronautics and an expert on the subject of aerodynamics. The German patent papers cover the method of constructing the variable pitch blades of the propellers which enables them to be adjusted with accuracy and facility, giving immediate positive dynamic control as well as delicate and sensitive adjustment of the airplane at extremely slow speeds and even in stalling positions of a plane, and at times where the standard method of control by ordinary ailerons which depend upon forward motion of the airplane for their efficiency, would not apply at all.



The propellers revolve continuously, being driven by the motor of the plane either by cable, shaft or an electric motor to be used only when the main motor fails, to enable a forced landing to be made in safety.

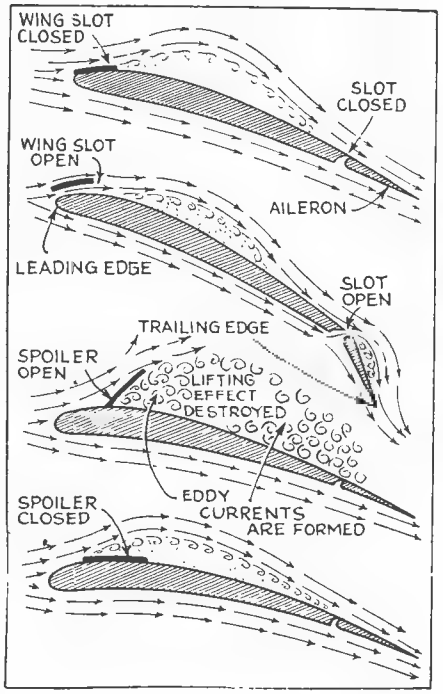
The blades of the horizontal propellers, placed at the wing tips, are so connected to the control stick that their pitch may be varied while running, causing either end of the airplane wing to be lifted at will. When not in use they run idle without any pitch, absorbing very little power.

They are brought into use after the ailerons become inefficient through the airplane stalling, spinning or in flight at such a slow speed that ailerons become useless. This appliance would enable an airplane to fly very slowly because if the ailerons are used to increase the lift, by being depressed on both sides simultaneously, positive control by means of these variable pitch horizontal propellers can be used.

This is a way to enable an airplane to approach the bird's ability to get along without "airports." It can start and stop practically everywhere. This means you can use an airplane like an automobile and can start and land on an ordinary large roof. This positive control is what the Guggenheim Competition aimed at. Increased control and high lift at slow speeds can be obtained in this way with very simple means, without changing the present structurally perfect airplane which combines the greatest strength and the most efficient form with the least weight.

Wing slots are air guides used to keep up the smooth flow of the air over the upper wing-surface of an airplane, even when it is at the "burble point" or point when it would otherwise "stall" or be inclined so steeply that the air flow cannot continue. "Spoilers" are flaps on the top surfaces of the wing which are raised to destroy the smooth flow of the air over the upper wing-surface or cause it to loose its lift. They act in the opposite way to slots and when one side is too high, the spoiler is used to bring it down.

Slots and spoilers help, but rotary ailerons work even when slots and spoilers have reached the limit of their action. Rotary ailerons function even when the plane stands still. They should be used as the climax to other means of control. An ordinary airplane, as it has been developed, is remarkably strong and light but it must have better control than it has now; yet not at the expense of the perfection the plane has reached in aerodynamical efficiency.



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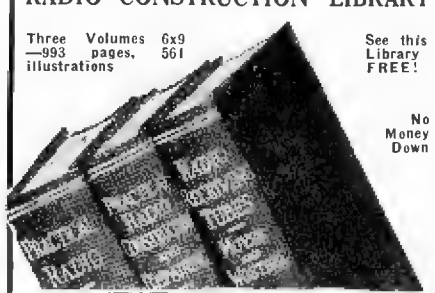

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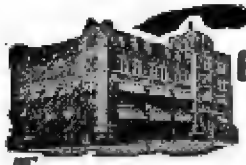

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AMAZING NEW CHAIN SELLING SYSTEM Brings Beginner a year's pay in 4 summer months!

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DOUBLE PAY for your "over-time"—write today!

Hurry—big season just starting—big earnings for you right off the bat. Clever "demonstrator" free—weighs only a few ounces—write immediately for Chain Selling Plan, stating territory, etc.

The PROGRESS PAINT CO. Cleveland, O. Dept. 151

Hind-Side-Before

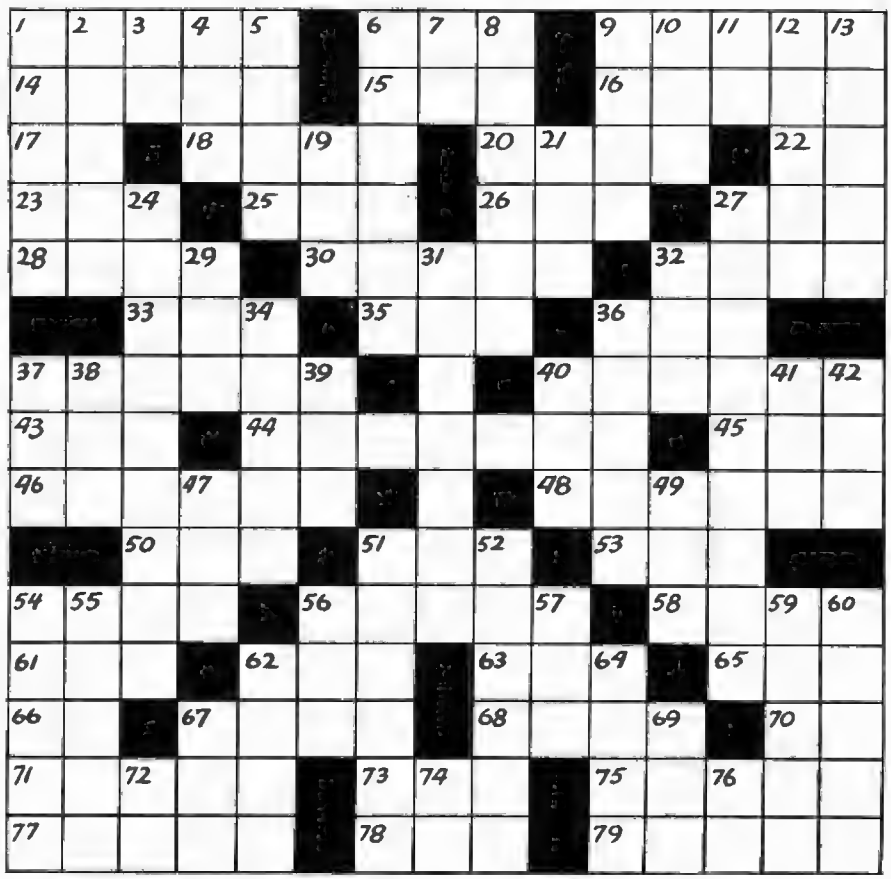
A Cross-word Puzzle by RICHARD H. TINGLEY, C.E.

ACROSS

1. Calls loudly to.
6. Conventional form of respectful address to men.
9. City in Prussia where the "Big Berthas" were made.
14. To put or keep apart.
15. To do a thing habitually.
16. Fishing net.
17. The title of Col. Lindbergh's book.
18. Above zero; the reverse of minus.
20. Exceeding.
22. One or any.
23. Female deer.
25. The dregs of the people.
26. To anoint.
27. A unit of work and energy rate in the Centimeter-gram-second system.
28. Yields a clear profit above all expenses.
30. Vanishes gradually.
32. Any smooth, unaspirated consonant.
33. Met in assembly for deliberation.
35. Saturated.
36. Belonging to an object of the neuter gender.
37. The "Sage Brush State."
40. An orderly arrangement of things one after another.
43. A skein of yarn of 120 yards.
44. Places by influence or force.
45. Strong resentment.
46. Imprisonment.
48. The two hind quarters of a carcass of mutton, venison, etc.
50. Excited beyond self-control.
51. An anarchist.
53. The short fibers on the surface of flannel or a silk hat.
54. Such, as mentioned, and no more.
56. Cauterized (variant in spelling).
58. A "U" or an "S" bend in a drain pipe.
61. Given something to eat.
62. To humbug, or to deceive in a joke (slang).
63. Perch.
65. Recently produced.
66. Fourth note of the musical scale.
67. A marsh-hunting, wading bird.
68. Gamins.
70. To have actuality.
71. Scolder.
73. The constellation of the "Altar."
75. To provide for the gratification of a need or taste.
77. Two pieces.
78. A man affectedly fastidious in dress.
79. Any soft, sticky, dirty substance.

DOWN

1. Prophets.
2. Altar cloth.
3. The square root of thirty-six.
4. The swell of the ocean.
5. Small tree-like plant.
6. Disposition to become angry.
7. The seventh note of the musical scale.
8. A large marine seal-like mammal.
9. Heated chamber for cooking.
10. A single thing or person.
11. Exists.
12. Sea eagles.
13. Demise.
19. The fifth note of the musical scale.
21. An interjection of disapproval.
24. Leagued.
27. Deviating from the true course.
29. An advance guard.
31. Took rest.
32. A suffix denoting "of the nature of."
34. The nine goddesses presiding over poetry, art and the sciences.
36. Works steadily.
37. A mineral spring.
38. Dejected.
39. Cavern occupied by wild animals.
40. The squares of a body of type used in printing (plural).
41. A metric measure of 119.6 square yards.
42. A little girl.
47. Deface.
49. Large floating leaf of a pond-lily.
51. Placed your car aside temporarily.
52. More speedy.
54. Customary pursuit or occupation.
55. Allude.
56. Assistance.
57. Roman god of the underworld.
59. More crippled.
60. Scarcely enough.
62. Dry.
64. Notable epochs.
67. Chum.
69. Encountered.
72. Near.
74. Either.
76. A thing.



Solution on page 90

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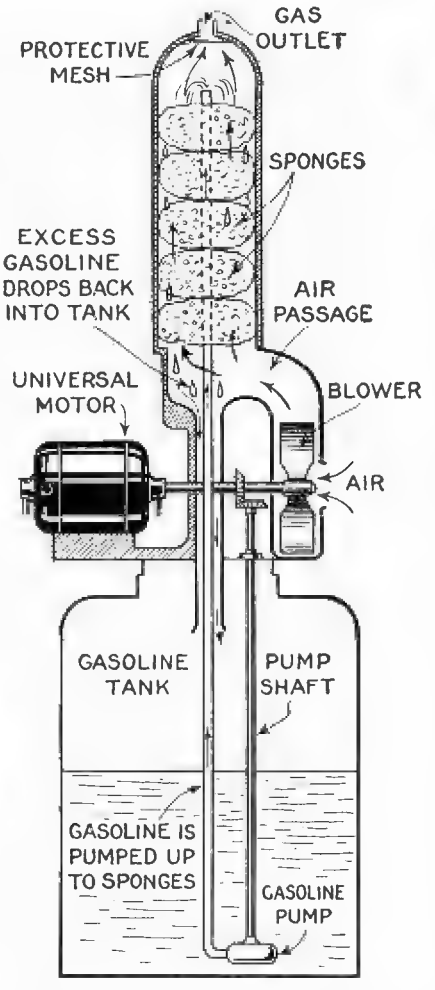
Home of the famous Keeley Treatment for Liquor and Drugs. Booklet Sent on Request. Correspondence Strictly Confidential.

Home Made Gas

By Don Bennett

THE man in the country may now make his own gas for both cooking and lighting purposes. And the cost is said to be less than that of city gas—seventy cents per thousand cubic feet, as against a dollar.

The device for manufacturing this gas, the "Gasolier," is said to be safer than the ordinary kerosene and gasoline stoves in use, for the fumes do not paralyze the olfactory nerves as is the case with illuminating or coal gas. The apparatus may be placed in the cellar or the kitchen —is compact enough to fit in a small space.



This diagram explains how the gasoline is pumped into the reservoir, mixes with air from the blower, and rises as gas in the collector.

A one-quart jar—the maximum size container approved by fire underwriters for use inside dwellings—comes with the outfit. But a large storage tank for gasoline, outside your house, will provide a reserve supply.

The principle of operation is easily understood by referring to the drawing. Gasoline is forced by a pump into a reservoir containing several layers of sponges, which become saturated, presenting a large surface for evaporation. Air from the blower mixes with the gasoline in the reservoir, and the gas thus formed rises into a collector. Excess gasoline flows back to the storage tank.

EARLE LIEDERMAN, "The Muscle Builder"
Author of "Science of Wrestling," "Muscle Building," "Here's Health," "Secrets of Strength," "Endurance," etc.

The Power of Truth

Truth is often stranger than fiction. That is a fact. Sometimes the truth is unbelievable, nevertheless strange as truth may seem, there is a mighty convincing unseen power behind it, from which you cannot flee. Sometimes we dread to face the truth, but why blindfold ourselves? Let us face facts **truthful facts**—right now.

The Truth About Development

You may imagine that a thin sickly individual cannot develop himself to massive muscular proportions, but the truth of the matter is HE CAN. He should, during the first month, easily add one inch to his upper arms and two inches to his chest and every month thereafter, increase those parts of his body in proportion to nature's laws—**and it is a law of nature to progress through activity.** And while the arms and chest are gaining, every muscle throughout the entire body will respond in similar proportions. **That is the truth about development.**

The Truth About Strength

Your strength can be doubled in a very short time. That is an actual fact. If you, for example, are only capable of lifting 75 lbs. overhead today, in a month or two you should very easily be able to lift twice that weight, or 150 lbs. You will be amazed at how rapidly your strength will increase under proper guidance. In some cases the strength can be doubled in a few weeks' time. **That is the actual truth about strength.**

The Truth About Health and Vitality

Some have an erroneous idea that exercise exhausts and takes away from the stamina and energy. On the contrary. Exercise is nature's way of stimulating the internal organs and, remember, for every action there is a reaction. Each time you affect the respiratory system you are benefiting your lungs. Each time you perform proper abdominal movements you are stimulating most of your internal organs and when the lumbar region, which is the seat of the central nervous system, receives systematic and scientific work, you positively stimulate your vital energy, which in turn fills you with that mysterious power—"vitality," and arriving with this is perfect robust health. **That is the truth about health and vitality.**

The Truth About Earle Liederman

In conclusion, you should make sure that your instructor is one who is qualified in every respect to guide you. He should be one whom you can respect and like and one who will take a personal interest in your individual welfare. He should be a college man of wide experience in travel, for remember, the exercises performed by tropical students should not correspond with those in the far north. He should have 20 or more years of experience and have at least 100,000 students to enlarge his practical knowledge. Such a man is Earle Liederman. He tells you things straight from the shoulder and he has a system of muscle building that has become almost a houseword throughout the entire world. He guarantees every promise and will refund all money if he cannot live up to his word. That is the truth about your future instructor, Earle Liederman.

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Why not send for a copy today? Write now while it is on your mind.

EARLE LIEDERMAN, Dept. 2705, 305 Broadway, New York

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Dear Sir: Please send me, without any obligation on my part, whatever, a copy of your latest book, "Muscular Development."

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City . . . . State . . . .

(Please write or print plainly)

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As you turn the pages of this magazine, you see the advertising of things you need. Food, clothing, home equipment . . . all the necessities and luxuries that go to make up the fullness of modern living.

Has it ever occurred to you to wonder just how far you could trust these advertisements as reliable guides to the selection of worthy products?

We can answer your question in one broad statement. *Any product or service that you see consistently advertised in the pages of this publication is worthy in quality, honestly priced and truthfully presented.*

Why? For the very simple reason that to the maker and the seller of an unworthy product, advertising presents the quickest and surest road to failure. To the misrepresented product, advertising brings a sudden and fatal storm of public disapproval. To the dishonest maker, advertising brings a constant public reminder of his dishonesty.

Truth in advertising has come to stay . . . its use is no longer dependent on the *integrity* of the advertiser, but on his *business ability*. *Nothing else pays.*

And, in addition, the publishers of your magazine make every effort to disbar from these pages any advertising that might prove objectionable or unprofitable in any way to its readers.

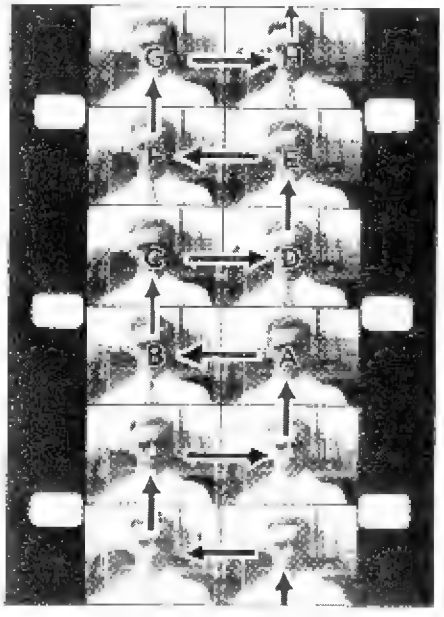
Read the advertisements here. They offer you a dependable short cut to the kind of merchandise you would select if you spent your day in shopping for it.

BUICK 4-DOOR SEDAN
5 CARS GIVEN!
SEND NO MONEY! REPLY TODAY
$705.00 for PROMPTNESS
Ever win a prize? Here's your chance! Every year we spend over $150,000.00 on prize offers to advertise our business. In this new offer 150 grand prizes totaling $6555.00 will be given to the fortunate ones who solve our puzzle correctly and win. Here it is—
FIND THE "DIFFERENT" AUTO!
The 16 cars in the circle all look alike. 15 of them are exactly alike—but one is different from all the rest. That's the trick for you! Find this "different" car if you can—and mark it. The difference may be in the fenders, bumper, name plate, radiator, or top. Be careful now—because winner must solve puzzle correctly in order to qualify for this opportunity to
WIN BUICK SEDAN OR $2035.00 CASH
A magnificent list of 150 Grand Prizes—$6555.00 in all! Lucky first prize winner has choice of new 1930 Buick 4-door Sedan or cash if preferred. Also four other fine new Sedans, radios, victrola, etc., in big prize list. Duplicate prizes awarded in case of ties. *All actively interested who have answered correctly will receive prizes or cash rewards.*
$705.00 FOR PROMPTNESS
Don't delay—act this minute! Solve the puzzle correctly and receive at once Certificate good for $705.00 if you are prompt and win first prize, making total first prize worth $2035.00 *This is the only puzzle to solve.* Any man, woman, boy, or girl in the U. S. A., outside of Chicago, may submit an answer. 150 of the people who take up this offer are going to win these splendid prizes. Be one of them. Send the number of the "different" auto in a letter or post card today. Nothing to buy, so send no money. But act promptly! B. A. BLACK, 500 N. Dearborn St., Room 210 Chicago

Motion Picture Camera Cuts Operating Costs

A NEW motion picture camera, priced within the range of the average amateur home movie equipment owner, has been evolved after many years of experimenting. It is called the "Homovie," and is said to cut operating costs seventy-five percent.

Home motion picture cameras use 16 millimeter film rolls, 100 feet in length, which provide four minutes of screen entertainment. Only lengthwise motion of the film is employed.



The arrows indicate the path of the film past the Homovie camera lens.

In the Homovie camera, the film moves both longitudinally and laterally across the lens, alternately, and the composite movement of film and shutter mechanism produces a series of views arranged in two columns on the film.

Operation of the Homovie camera is simple—focus through a view-finder, press a button which releases a spring, and the horizontal and lateral motion begins.

Besides the camera proper, a Homovie projector and daylight recreator are provided. The latter permits showing pictures in broad daylight. A mirror at an angle of 45 degrees, shielded from light, reflects the pictures through a translucent glass screen. A special heat-absorbing glass shutter prevents breaking or blistering the film.

Solution to Puzzle on Page 88

S	L	I	A	H	■	R	I	S	■	N	E	S	S	E
R	E	V	E	S	■	E	S	U	■	E	N	I	E	S
E	W	■	S	U	L	P	■	R	E	V	O	■	N	A
P	O	D	■	B	O	M	■	L	I	O	■	G	R	E
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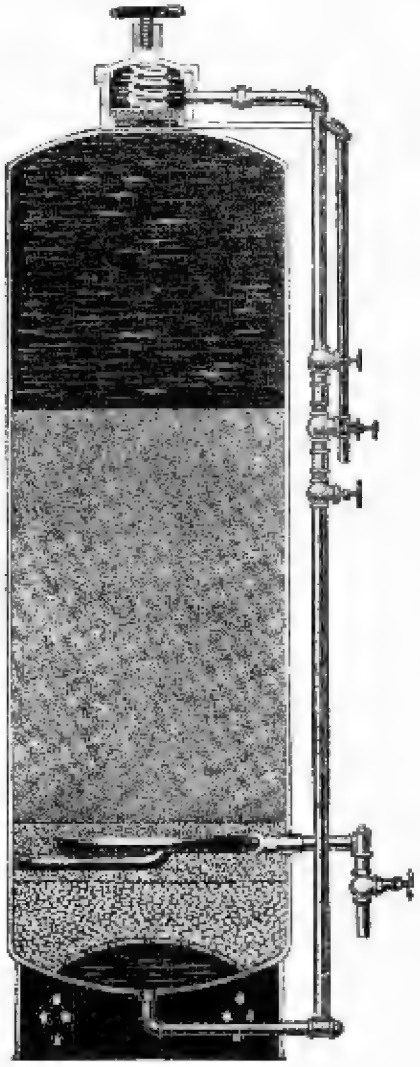
A	F	■	L	I	A	R	■	S	D	A	T	■	M	A
R	E	T	A	R	■	A	R	A	■	R	E	T	A	C
T	R	A	P	A	■	P	O	F	■	E	M	I	L	S

Water Softeners

DO you try to make a lather and find it difficult? Does your drinking water taste limy? Are your hot water pipes clogged and rusty?

These conditions indicate that your water is hard. And when there are so many advantages in having soft water, and it is comparatively easy and inexpensive to remove the hardening compounds from your water, soft water should be used.



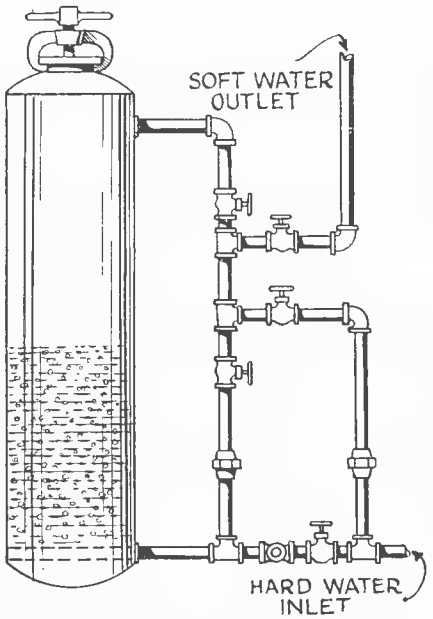
Reiter Co. Elgin Water Softener

A triple strata of filtering material at the base and a refilter at the top are features of this softener.

Water softeners are available which soften both permanent and temporary hard water. Non-corrosive tanks, seamless and equipped with a minimum of valves and caps are used. A synthetic softening material, such as "zeolite," is employed to attract the elements of hardness from the water. Then the softened water flows into the service pipe.

Softeners are equipped to purify a certain grain capacity of hardness per gallon. When the quota is absorbed, the zeolite loses its force unless regenerated. The introduction of common salt or brine usually is sufficient for this process. The Hardin-Lavin softener operates on the upflow principle, which is claimed to facilitate the regenerating process.

Filters are provided in the tanks to aid in purification and to collect the suspended matter which is dropped from the softener. One type, the Elgin, has a special backwasher which permits cleansing the filter at the base of the tank without passing the wash water through the zeolite or interfering with the softener's operation.



Hardin-Lavin Co.

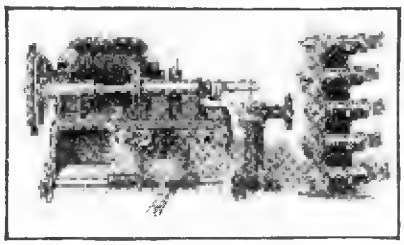
Hard water enters at the bottom, flows upward through the softening material, and out, as soft water.

A Key-Making Machine

FIRST keys to steering wheels, tire locks, padlocks, house keys, bitted and doubled-bitted keys with side and upper groves may be made in less than one minute with the latest key machine, it is claimed.

This contrivance is said to do away with taking locks apart and to eliminate hand filing and changing gears. An internal shaft controls the speed cutters.

To make almost any type of key—four flat keys may be cut at one time—the number of the lock desired is selected through a code and the proper blank and guides are clamped on the machine. Seventeen sets of guide keys stamped of pressed hard steel are provided in the equipment. The machine itself has an adjustable thumb screw for cutting deep or shallow wards.



Beisser Key Machine Co.

Rotary Hand Duplicator

A SIMPLE rotary hand duplicator, called the Radiograph, for reproducing both type and drawn patterns, has been put on the market.

The stencil containing the copy is placed on the machine, which is then inked and rolled over the paper. The roller automatically returns to its starting position. The printed copy is removed, and the machine rolled across the next paper on the pile.

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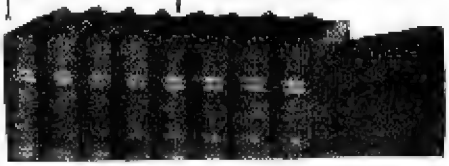

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Your Glider's Flying Clothes

(*Continued from page 77*)

not only improve the appearance of your work but at the same time strengthen the covering against tearing. Some builders outline each rib by running a strip of tape around the wing over each of the rib positions. This tape is very handy to have on hand later for use in quick repairing of small tears in the wing fabric.

Two more coats of dope should next be applied to the covered surfaces allowing at least four hours drying between coats. It is permissible to apply a coat of good Spar Varnish to the finished wings if a more glossy surface is desired.

Next assemble the whole glider and connect all the wiring. You will have a complete glider without a seat or back rest for the pilot. The proper placing of the seat and back rest is one of the most important factors in making your glider control easily in the air. A fire place log or similar round wood piece of about six or seven inches in diameter is placed on the ground in front of the runner. With the help of two or more assistants lift the glider and roll the log under the runner so that it will serve as a pivot for balancing the whole ship from this point under the ash skid. The two seat brackets may be fastened to their position on the top of the runner and the seat itself should be set temporarily on these brackets. Measure back 21 inches from the leading edge of the wing near the butt end wing connection and attach a small line with a weight attached to its free end. With a man at each wing tip level the glider so that the weighted line will indicate a position for the log to be placed under the runner directly under the cord attachment to the wing. Tie the back rest with its attaching pieces to your own back and seat yourself in the glider. By moving your seat forward or backward you will find a position where you can balance the glider for a second or two. Have one of your assistants mark the positions for mounting the seat and back rest. In this manner you are placing your weight so that the point where the glider balances is practically under the center of lift of the wings. A man lighter than you should be seated farther to the front and a heavier man should be placed farther back. This is the experimental and easiest way to adjust a new glider for flight. When the glider with its pilot in position has a point of balance directly under the center of lift of its wings it will practically glide itself in still air.

Some adjustment for the differences in weight of pilots can be made by raising or lowering the back edge of the stabilizer, raising it for a heavier load and lowering it for a lighter load. If the glider is carefully adjusted to an average loading it is not absolutely necessary to change the stabilizer from its original position.

A Correction

In the April issue in the article headed "One More Step to the Take-off," by Lieutenant H. A. Reynolds, there is a diagram captioned "Cable Control Diagram" in which the cable on the left side goes to the bottom horn of the left aileron, and the cable on the right side to the bottom horn of the right aileron. The connections should be made as indicated in the diagram captioned "Front View Showing Aileron Control." The latter is correct; the control cable from the left side of the control stick should go to the top horn of the left aileron, and the cable on the right side of the control stick to the top horn of the right aileron.

Pull Them In With a Heterodyne

By George R. Brown

(*Continued from page 31*)

tendency for oscillation appear when the gain reaches a certain value per stage. The maximum gain would, of course, be reached with good shielding, by-passing of each stage to eliminate coupling by common impedance, and neutralizing. No purpose would be served by using a tuned secondary transformer for coupling three-electrode tubes, because all of the gain obtained by tuning only the secondary cannot be used even with perfect shielding and neutralization.

The four-electrode shield-grid tube, however, has radically different properties from the three-electrode tube. The presence of a shield between the grid and the plate reduces the capacity between the grid and the plate. The shield does not materially change the input grid-to-filament capacity—on the other hand, the plate-to-filament capacity is considerably increased.

In such tubes the short-circuiting effect of the output capacity is several times the short-circuiting effect of the input capacity. Since tuning either the primary or the secondary of a transformer has the effect of removing either the output capacity or the input capacity respectively, the idea is immediately suggested to tune the primary.

After determining that the primary of the transformer must be tuned, there is left one remaining possibility, namely: tuning both the primary and secondary. Tuning the secondary would, of course, eliminate the short-circuiting effect of the input capacity of the tube. When both the primary and secondary are tuned, a maximum transfer of energy no longer takes place with close coupling. The condition for maximum transfer of energy is, to the contrary, a very loose coupling. Since space limitations eliminate the possibility of separating the primary and secondary by a space of six or more inches, depending upon the type of coil used, it was necessary to turn one of the coils so that it was practically at right angles to the other. It was found, however, that there is no such thing as perfect shielding. The gain which can be obtained with the tuned primary transformer is more than can be successfully used. The tuned primary transformer gave a gain of 75 per stage at a frequency of 475 kilocycles with complete copper shielding and by-passing. It was found, however, that this gain had to be reduced for stable operation. For this reason the tuned primary and secondary transformer was found to offer no advantages from a standpoint of the amount of amplification which could be used in the set, and it had the distinct disadvantage of an additional adjustment for each stage.

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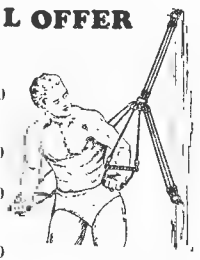

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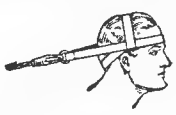

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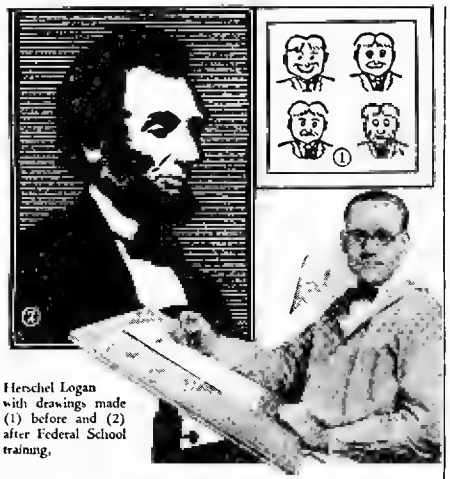

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(While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.)

The Gold Mine of Chemistry

By Alfred M. Caddell, *Financial Editor*

WE have heard a lot about this being an electrical age. It is. Electricity is fast remaking the world. But so also is chemistry.

During the last several years some enormous chemical industries have come into being. As an industrial group chemical concerns have no specific birthday. The science itself dates back to the remotest antiquity, but modern chemistry, as differentiated from the works of the alchemists, dates from the time of Lavoisier, about 1770. The World War period, however, ushered in the gigantic chemical combines, or at least nourished their growth into enormity, so that today we have industries capitalized at hundreds of millions of dollars, the equities of which are held by several million American and foreign stockholders. Truly, *via* stock ownership, no less than by the products of chemistry, each and everyone of us has become vitally and most favorably affected—chemistry is also remaking the world.

Let us look at a few of the outstanding chemical concerns whose equities are widely held by the public. Eastman Kodak, although thought of primarily as a camera concern, is the maker of film for the universally known kodak, for natural-color home motion-picture cameras, movie projectors, films, check-copying devices, educational film libraries, to say nothing of the chemicals used in developing and allied work. Since 1902, net profits have amounted to about $365,000,000, of which $260,000,000 has been disbursed in preferred and common dividends. Union Carbide & Carbon, makers of 116 different products ranging from electric light batteries to synthetic alcohol, is another giant in the chemical world. Air Reduction, producers of nitrates, etc., Allied Chemical, American Agricultural, American Cyanamid, Columbian Carbon, Commercial Solvents, Davison Chemical, Texas Gulf Sulphur, Tennessee Copper & Chemical, Corn Products, the great du Pont de Nemours companies and the innumerable industries founded on basic cellulose total tremendously in size and, what is more, an analysis of the whole chemical structure suggests that the present status, stupendous though it is, is really but the beginning. Indeed, chemistry bulks so largely on the immediate horizon that ten years from now it may look even bigger. It is transforming the automobiles we ride in, the clothes we wear, the houses we live in, the food we eat, to say nothing of our daily habits and modes of living.

Take a look at cellulose, for instance. If you are a girl and your thoughts run to silk stockings, dainty underthings, fancy hats and the innumerable dudads that enter into feminine life, think of the chemists who convert corn stalks, trees, straw and such like into "silk." Give paper a thought, too, and motion picture film carrying the likenesses of your favorite screen stars; and mosaics, statues, neckties, stockings, undies, laces, twine, sausage casings, Bakelite, artificial leather, lacquers, solvents, gun cotton, billiard balls, insulating board (which is fast displacing much lumber) and countless other things. All are chemical products.

Coal-tar products offer the basis for innumerable other phenomena. The great dye industries, the basis of all colorings in clothing, wall papers and such like, have their foundation in this branch of chemistry. The alcohols provide another basis, and so on throughout the whole list of enterprises.

Need we cite a few figures to drive home the import of the chemical industries? We'll look over some export figures only, which cover but a small part of the internal consumption of chemicals that go into the processes of manufacture.

In 1929 the exports of chemicals alone amounted to $152,162,000. Pigments, paints and varnishes led with a total of $29,199,000. Industrial chemicals were second with $28,194,000; medicinals and pharmaceuticals third, with $21,282,000, and fertilizers and materials fourth, with $20,194,000. Export totals of other groups were: Coal-tar products, $18,059,000; soap and toilet preparations, $16,059,000; industrial chemical specialties, $14,457,000. Imports run almost as big—methanol from Germany, cosmetics, powders, creams, soap ingredients, shellac, crude rubber from other parts of the world provide a cross-section of the great chemical picture that is constantly undergoing change and enlargement—now so large in fact, that economists throughout the world have attempted to encompass its bigness by pronouncing our era, the Chemical Age.

Questions and Answers

Conducted by Alfred M. Caddell

Information on securities will be furnished readers of "SCIENCE AND INVENTION" free of charge by mail and through these columns. A 2-cent stamped, self-addressed envelope should be included in your letter. Address your inquiries to the Financial Editor, Science and Invention, 381 Fourth Ave., New York City.

Question—Please give me some information on Baldwin Locomotive and tell me what you think of this stock. A. B. B., Toledo, Ohio.

Answer—This company is one of the two largest locomotive manufacturers in the United States; also owns some steel plants and other properties which add greatly to the company's assets. Funded debt consists of $5,798,850 first 5s, due 1940. Capitalization consists of $20,000,000 7% preferred and 800,000 shares of no par common. Earnings have been somewhat irregular. From 1921 to 1923 earnings on the old common (before the four-for-one split-up last year) averaged $20.94 per share. In 1924, 1925 earnings did not cover preferred dividends, but, since then payments have been regular. In 1926 the net income amounted to $22.42 per share; in 1927, $5.21; in 1928, $1.66. The rate on the new stock (800,000 shares no par common) is $1.75 a share. The stock must be regarded as somewhat speculative.

Question—I bought twenty shares of Crocker-Wheeler at higher levels than the present market. Would you advise holding or selling? G. W. C., Pelham, N. Y.

Answer—It is impossible for anyone to accurately forecast the market regardless of their self-alleged ability, but a few facts might enlighten you upon the status of this stock. Earnings for the years ending Dec. 31, 1929, were $1.75 a share as against 36 cents a share for 1928. The company is long established and manufactures generators, motors, transformers and other electrical apparatus. In Sept., 1929, the old stock was split ten-for-one and no dividends have been paid up to this writing on the new stock—in fact, nothing has been paid since April, 1925, although dividends were paid on the old $100 par common from 1891 to that date. All arrears on the cumulative preferred from 1891—there were but two years' interuption—were paid up at the time of the capital split-up and the stock retired last November. It is my opinion that this stock represents a speculation, and at this writing it is not possible to stay what the outlook is.

Question—Is the $5 dividend for American Safety Razor safe? Mrs. G. M. C., Topeka, Kansas.

Answer—I think it is safe to say that it is. This company is firmly entrenched in its field, ranking second among the safety razor companies. Company's business is rapidly expanding. The year 1929 was the best in the company's history, showing about 27% increase over previous year. This gain in net income would mean $7 per share after all charges on the 200,000 shares outstanding. Sales are showing steady growth and the company is in a strong financial position, having more than $3,000,000 in cash after having purchased 28,112 shares and retiring them from the market.

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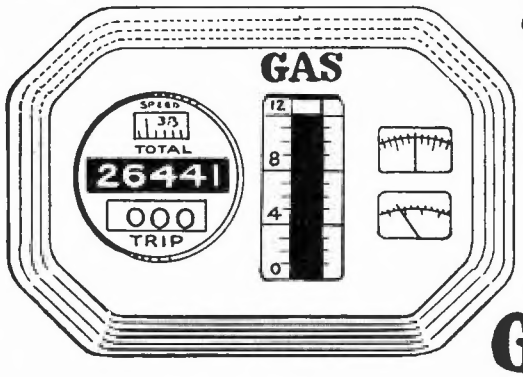

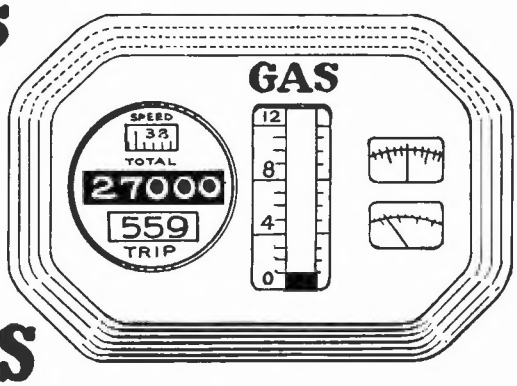

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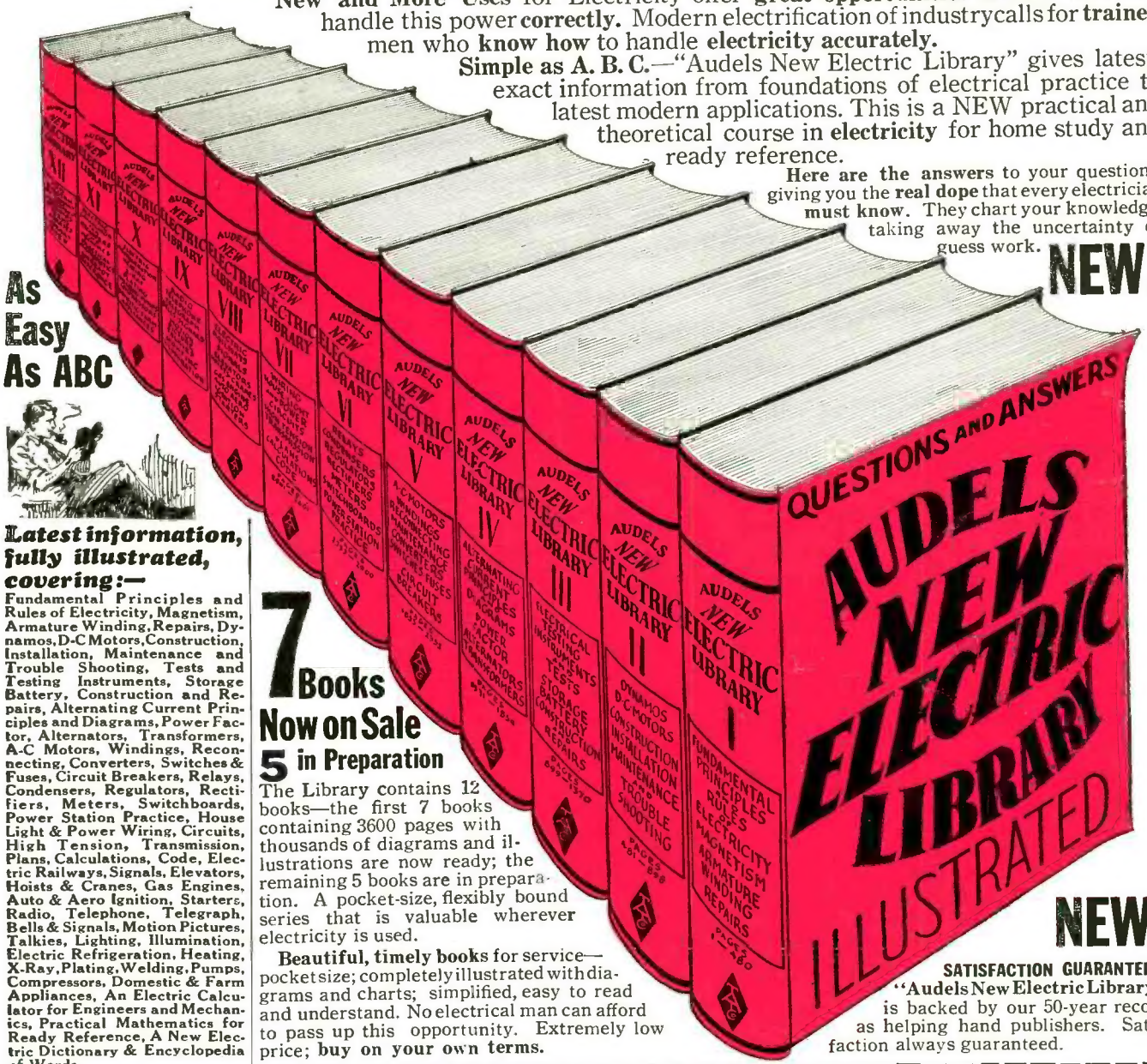

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Who said, "Give me liberty or give me death"?
Which freezes quickest—water, mercury, alcohol?
Do fish sleep?
What is a pentameter?
Who wrote *Virginibus Puerisque?*
What nation first divided time into months, weeks, hours, minutes and seconds?
Where was the Pantheon?
Why is glass transparent?

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